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PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

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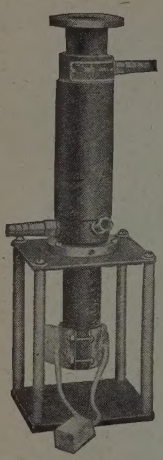
ABSTRACTS 1212–1500

Vol. 47 JUNE, 1944 No. 558

EDWARDS' MERCURY DIFFUSION PUMPS



A Type 3 diffusion pump on stand with heater.

Characteristics.	*Type 2.*	*Type 3.*
Speed, litres per second ...	6–8	2–3
Ultimate vacuum, mm. Hg....	10^{-6}	10^{-6}
"Backing Pressure," mm. Hg.	0·5	0·5
Heat input, watts	300–500	150–200
Mercury Charge, ccs. ...	50	20
Weight, lbs....	9	3

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Type 3 pump - £12 14s. 0d.

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CONTENTS—ABSTRACTS 1212–1500

		Page
159	Psychology	109
355	Military science	109
51	Mathematics	109
52	Astronomy	111
523.7	Sun	112
523.8	Stars	112
525	Earth	114
526	Geodesy	114
53	Physics	114
530	General principles	114
531	Mechanics	114
531.7	Measurements	114
532	Liquids	115
532.13	Viscosity	115
532.14	Density	115
532.5	Hydrodynamics	115
532.6	Surface tension	115
532.7	Osmosis. Solution	115
533	Gases	116
533.6	Aerodynamics	116
533.7	Kinetic theory	116
534	Acoustics. Vibrations	116
535	Optics. Radiation	117
535.24	Photometry	117
535.3	Reflection. Refraction	118
535.33	Spectroscopy	118
535.338	Spectra	118
535.34	Absorption	119
535.37	Fluorescence. Luminescence	119
535.4	Diffraction. Scattering. Interference	119
535.5	Polarization	120
535.6	Colour	120
535.7	Vision	120
535.8	Instruments	120
536	Heat	120
536.7	Thermodynamics	121
537	Electricity	121
537.5	Electric discharge	122
537.531	X-rays	122
537.533	Electron radiation	123
537.534	Positive rays	123
537.56	Ionization of gases	123
537.59	Cosmic rays	123
538	Magnetism. Electromagnetism	123
538.56	Electromagnetic oscillations	124
539.13	Molecules	124
539.15	Atoms	124
539.16	Radioactivity	125
539.2	Molecular systems	125
539.26	X-ray examination	125
539.3	Elasticity. Deformation	125
539.4	Strength of materials	126
539.5	Deformability	126
539.6	Friction. Cohesion	126
54	Chemistry	126
541.12	Reaction kinetics	126
541.128	Catalysis	127
541.13	Electrochemistry	128
541.14	Photochemistry	129
541.18	Colloids. Adsorption	129
541.2	Mol. and atomic weight	129
541.5	Valency. Bonds	129
541.6	Chemical structure	130
542	Apparatus	130
543/545	Analysis	131
546	Inorganic chemistry	131
547	Organic chemistry	131
548	Crystallography	131
549	Mineralogy	132
55	Geophysics	132
550.34	Seismology	132
550.38	Terrestrial magnetism	132
551.5	Meteorology	133
553.621	Quartz	135
612	Physiology	135
614.7	Air pollution	135
621.7	Workshop processes	135
629.1	Transport engineering	135
629.12	Ships	135
66	Industrial chemistry	136
666	Glass. Ceramics. Concrete	136
669	Metallurgy	136
678	Rubber	136
679.5	Plastics	136
691.16	Bituminous substances	136
697	Heating. Ventilation	136
77	Photography	136
796	Field sports	136

Abstracts signed "E. R. A." are supplied by courtesy of the British Electrical and Allied Industries Research Association. Abstracts signed "M.-V." are supplied by courtesy of the Metropolitan-Vickers Electrical Co. Ltd.

159.93 : 77 1212

Psychophysics and photography. JONES, L. A. *J. Opt. Soc. Amer.*, 34, *pp.* 66–88, *Feb.*, 1944.—After a discussion of the field of investigation denoted by the term "psychophysics" and a description of the work so far done in the section devoted to light and vision, the author discusses the factors entering into a psychophysical evaluation of picture (photograph) quality. He describes investigations made to determine (*a*) optimum exposures using papers of different contrast characteristics and (*b*) the relation between print quality and exposure of negative. This leads to a definition of the "speed" of a negative material.

J. W. T. W.

355.4 : 551.582 *see Abstr.* 1483

511.3 1213

An arithmetical identity. GAGE, W. H. *Trans. Roy. Soc. Can.*, 37, *pp.* 9–11, *May*, 1943.—A new identity is obtained involving a general type of function and some simple applications are given. Several recursion formulae are obtained for the class-number functions. L. S. G.

511.482 1214

A type of universal arithmetical forms. BELL, E. T. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 375–378, *Dec.*, 1943.—A form $F(x, y, \ldots w)$ in the variables $x, y, \ldots w$ is defined to be a polynomial with integer coefficients and no const. term. Types of forms are studied such that, given certain integers n, there exist integers $x', y', \ldots w'$, all different from zero, for which $n = F(x', y', \ldots w')$. L. S. G.

511.83 1215

Simple illustrative methods for computing π. BACON, R. H. *Amer. J. Phys.*, 12, *pp.* 49–50, *Feb.*, 1944.

512.31 : 512.5 1216

A simple method of interpolation. SAMUELSON, P. A. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 397–401, *Dec.*, 1943.—A new method is given for solving the classical problem of fitting a polynomial $f(x)$ to the $(n+1)$ given values (x_i, f_i) $(i = 0, \ldots, n)$. The polynomial $P_{n+1}(x) = \prod_0^n (x - x_i) = x^{n+1} + b_1 x^n + \ldots + b_n x + b_{n+1}$ is computed (a rapid method for doing this is given) and then the polynomials $P_i(x) = x^i + b_1 x^{i-1} + \ldots + b_i$ $(i = 0, 1, \ldots, n)$ are set up. The unknown coefficients of $f(x)$ are given by

$$a_j = \sum_{i=0}^{n} P_{n-j}(x_i)/P'_{n+1}(x_i) \quad (j = 0, \ldots, n)$$

Rapid methods for evaluating $P_{n-j}(x_i)$ and $P'_{n+1}(x_i)$ involving synthetic division, are given. The amount of effort required in the method is compared with other methods, in particular the Aitken method of interpolation; if 2 or more readings are desired, the work is about equal to that of the Aitken method, and for more than 2 readings it is much less. L. S. G.

512.5 : 512.31 *see Abstr.* 1216

512.831 1217

Efficient computation of the latent vectors of a matrix. SAMUELSON, P. A. *Proc. Nat. Acad. Sci., Wash.*, 29, *pp.* 393–397, *Dec.*, 1943.—Let $\mathbf{A}$ be an $n \times n$ matrix, whose latent vectors are required and $\mathbf{H}$ an arbitrary column vector. The matrix products $\mathbf{H}_0 = \mathbf{IH}$, $\mathbf{H}_i = \mathbf{A}^i\mathbf{H} (i = 1, \ldots, n)$, are formed and, if the characteristic equation of $\mathbf{A}$ is $f_n(x) = \sum_{i=0}^{n} p_i x^{n-i} = 0$ $(p_0 = 1)$, the polynomials $f_i(x) = x^i + p_1 x^{i-1} + \ldots + p_i$ $(i = 0, 1, \ldots, n-1)$ are set up. Suppose that $(x_1, \ldots, x_n)$ are the latent roots of $\mathbf{A}$ and denote by $\mathbf{K}$ the square matrix $(\mathbf{H}_0\mathbf{H}_1, \ldots, \mathbf{H}_n)$. If the n latent vectors of $\mathbf{A}$, $V_i = (V_{i1}, V_{i2}, \ldots, V_{in})$ $(i = 1, \ldots, n)$ form the matrix $\mathbf{V} = (V_{ij})$, then it can be shown that $\mathbf{V} = \mathbf{KM}$ where $\mathbf{M}$ is the square matrix whose (i,j)th element is $f_{n-1}(x_j)$ $(i, j = 1, \ldots, n)$. L. S. G.

512.94 : 536.7 : 548.0 *see Abstr.* 1451

513.719 1218

Flat space congruences of order one in $[n]$. PURCELL, E. J. *Trans. Amer. Math. Soc.*, 54, *pp.* 57–69, *July*, 1943.—By an $[n-\kappa]$-congruence of order one in $[n]$, $\kappa < n$, is meant an algebraic ∞^κ-system of $[n-\kappa]$'s such that one and only one $[n-\kappa]$ of the system passes through an arbitrary point of $[n]$. On each $[n-\kappa]$ there is a $V^\kappa_{n-\kappa-1}$ all of whose points are fundamental. If $V^\kappa_{n-\kappa-1}$ is reducible and its components are of orders $A_1, A_2, \ldots A_w$ (where $\sum A_i = \kappa$) we denote the $[n-\kappa]$-congruence by $(A_1, A_2, \ldots, A_w)$. The paper gives a description and classification of $[n-\kappa]$-congruences including the fixed base (a determinantal locus). Congruences in ordinary space receive particular attention and it is shown that Aprile's congruence is of type $(n-1)_n$.

L. S. G.

513.738 : 531.1 1219

A generalized theory of dynamical trajectories. KASNER, E., AND CICCO, J. DE. *Trans. Amer. Math. Soc.*, 54, *pp.* 23–38, *July*, 1943.—A field of force is generalized if it depends not only upon the position of the point but also upon the direction through the point. The paper consists of a development of the geometry of the dynamical trajectories of such fields of force in the plane. The ∞^3 trajectories are represented by an equation of the form $y''' = G(x, y, y')y'' + H(x, y, y')y'^2$. [See Abstr. 1484, 1745, 2761 (1942) and 1559 (1943)]. L. S. G.

517.43 = 4 1220

On a generalization of the operator of projection $E(I)$. GOMES, R. L. *Portugaliae Physica*, 1, 1, *pp.* 29–34, 1943.—A new operator $E(A)$ is introduced, which operates on the elements of a Hilbert space. Its principal properties are studied and an application is made to quantum statistics. L. S. G.

517.5 1221

Entire functions bounded on a set. MACPHAIL, M. S. *Trans. Roy. Soc. Can.*, 37, *pp.* 31–38, *May*, 1943.—Let $f(z)$ be an entire function of minimal type of order one and let $z_1, z_2, \ldots$ be the zeros of the function $\phi(z)$. Conditions on $\phi(z)$ are given in order that we may deduce, from the condition $f(z_n)/\phi'(z_n) = O(|z_n|^{-2})$ when $n \geqslant q$, that $f(z)$ vanishes identically. Particular cases of $\phi(z)$ are Bohr's almost periodic functions and Bessel functions of any integral order.

L. S. G.

517.521.8 1222

On typical means. FUCHS, W. H. J., AND ROGOSINSKI, W. W. *Quart. J. Math.*, 14, *pp.* 27–48, *June*, 1943.—An application of a general theory of continuous Hausdorff methods [Abstr. 9 (1943)] to the study of summation by typical means: $s(x)$ is summable T to s if $t(x) = \int_0^1 s(xt)d\phi(t)$ $(x > 0)$ (1) tends to s as $x \to \infty$. Here $\phi(t) = 0$ if $t \geqslant 1$ and the integral is a Lebesgue–Stieltjes integral. Typical means are obtained by restricting the choice of $s(x)$ to λ-step functions. Let $0 = \lambda_0 < \lambda_1 < \ldots < \lambda_\kappa \to \infty$ and let $s(x) = \sum_{\lambda_\kappa \leqslant x} a_\kappa$, so that $s(x) = s(\lambda_\kappa) = \sum_0^\kappa a_l$ if $\lambda_\kappa \leqslant x < \lambda_{\kappa+1}$. Then $s(x)$ is a λ-step function and from (1) we obtain

$$t(x) = t^{(\lambda)}(x) = -\sum_{\lambda_\kappa \leqslant x} a_\kappa \phi\left(\frac{\lambda_\kappa}{x} - 0\right).$$

The $t^{(\lambda)}(x)$ are called typical means of $\sum a_\kappa$. The paper consists of a comparison of the strengths of various methods of summation by typical means.

L. S. G.

517.53 1223

A note on approximation by rational functions. KOBER, H. *Bull. Amer. Math. Soc.*, 49, *pp.* 437–443, *June*, 1943.—An L_p-theory $(0 < p < \infty)$ is given of the approximation by rational functions on the following point sets E of the z-plane: (i) the real axis—$\infty < x < \infty$, $y = 0$, (ii) the half plane $-\infty < x < \infty$, $0 < y < \infty$. Let α and β be two fixed points in the upper half-plane. Among the theorems proved is the following: If $0 < p < \infty$, c is an integer $> 1/p$, $F(t)$ belongs to $L_p(-\infty, \infty)$ and $r_\kappa = (\alpha - z)^\kappa (z - \beta)^{-c-\kappa} (\kappa = 0, \pm 1, \pm 2, \ldots)$ then there are finite linear combinations $s_n(z)$ of the $r_\kappa(z)$ such that $\left(\int_{-\infty}^{\infty} |F(t) - s_n(t)|^p dt\right)^{1/p} \to 0$ as $n \to \infty$.

L. S. G.

517.535.4 1224

On the approximation to integrable functions by integral functions. KOBER, H. *Trans. Amer. Math. Soc.*, 54, *pp.* 70–82, *July*, 1943.—Theorems are proved concerning approximation, both in the sense of convergence in mean with index p $(0 < p < \infty)$ and in the sense of uniform convergence $(p = \infty)$, on the following point sets of the z-plane: I. The real axis $-\infty < x < \infty$, $y = 0$. II. The positive part of the real axis $0 < x < \infty$, $y = 0$. The "best possible" order ρ of the approximating integral functions is 1 in problem I and $1/2$ in problem II. The latter problem may be reduced to problem I, for $1 < p < \infty$, by means of the approximation by rational functions [see Abstr. 1223 (1944)]. L. S. G.

517.564.3 : 517.86 : 517.942.6 1225

A short table of the toronto function. HEATLEY, A. H. *Trans. Roy. Soc. Can.*, 37, *pp.* 13–29, *May*, 1943.—The function tabulated is $T(m, n, r) = 2r^{n-m+1}e^{-r^2}T(m, n, 1, r)$ where $T(m, n, p, a) = \int_0^\infty t^{m-n}e^{-p^2t^2} I_n(2at)dt$, I_n being the modified Bessel function of order n. Differential equations satisfied by the T-function are listed and the relationship of the function to various other functions, incl. the error function and the incomplete gamma function, is pointed out. The tabulation covers the values $\pm 1/2$, 0, 1 for m and the range $-2(\cdot 5)2$ for n. The range for r is $0 \cdot 0(\cdot 2)4(1)6$, 10, 25, 50 for the values $\pm 1/2$, 0 for m and $0 \cdot 0(\cdot 1)3 \cdot 0$ for $m = 1$. L. S. G.

517.86 : 517.942.6 : 517.564.3 *see Abstr.* 1225

517.925 : 519.213 1226

Differential equations for the probability distribution of events. RUARK, A. E. *Phys. Rev.*, 65, *pp.* 88–90, *Feb.* 1 *and* 15, 1944.—The differential equations governing the probability distribution of events distributed over a multidimensional domain are derived. They are a generalization of the equations governing the probability distribution in a time series. Let $f_r(x, y)dxdy$ be the chance that an event will occur in the domain $dxdy$ when r events have already occurred in the domain $(0, x; 0, y)$. The equations then govern the set of functions $W_n(x, y)$, where W_n is the chance that n events occur in the domain $(0, x; 0, y)$. The problem of solving them reduces to the solution of a sequence of first-order ordinary equations. The general solution is written, and illustrations are given.

517.942.6 : 517.86 : 517.564.3 *see Abstr.* 1225

517.942.9 1227

On Whittaker's solution of Laplace's equation. COPSON, E. T. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 31–36, 1944.—The solution is

$$V = \frac{1}{2\pi}\int_0^{2\pi} f(z + ix\cos u + iy\sin u, u)du$$

where f is arbitrary, but it is not the most general. The following theorem is proved, which justifies Whittaker's solution under quite general conditions: Let $V(x, y, z)$ be continuous and have continuous partial derivatives of the first and second orders in the sphere $x^2 + y^2 + z^2 < r_0^2$, and let it satisfy Laplace's equation there. Then

$$V = \frac{1}{2\pi}\int_0^{2\pi} \sum_0^\infty F_n(u)\, U^n du$$

where $F_n(u)$ is a trigonometrical polynomial of degree n at most, and $U = z + ix\cos u + iy\sin u$, the series being uniformly convergent with respect to u when $x^2 + y^2 + z^2 < \frac{1}{4}r_0^2$. Here the constant $1/4$ is the best possible. L. S. G.

518.3 : 551.501.42 : 551.547 *see Abstr.* 1475

518.3 : 621.93 1228

Metal-cutting nomograph. For cutting steel with single-point tools. GILBERT, W. W., AND TRUCKENMILLER, W. C. *Mech. Engng, N.Y.*, 65, *pp.* 893–898, *Dec.*, 1943.—[Abstr. 1278 B (1944)].

518.41 : 621.318.2 : 538.24 *see Abstr.* 1372

519.213 : 517.925 *see Abstr.* 1226

519.24 1229

A note on tolerance limits. PAULSON, E. *Ann. Math. Statist.*, 14, *pp.* 90–93, *March*, 1943.—A problem arising in quality control is the determination of tolerance limits when the variability of the product is known to be due to random factors. A relationship between tolerance limits and confidence limits is pointed out, and this is used to establish tolerance limits when the product is de-

cribed by two qualities, the measurements on which re assumed to have a bivariate normal distribution. L. S. G.

519.251 1230

Asymptotic formulae for significance levels of certain distributions. PEISER, A. M. *Ann. Math. Statist.*, 14, pp. 56–62, *March*, 1943.—Let y_p be the $p\%$ point of the normal distribution defined by $\Phi(x)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x} e^{-v^2/2}dv$, so that $\Phi(y_p)=1-p$. If χ^2_{pn} and t_{pn} denote the $p\%$ points of the Chi-Square and Student's t-distributions with n degrees of freedom respectively, then $\chi^2_{pn}=n+y_p\sqrt{2n}+{}^2/_3(y_p^2-1)+(y-{}^3_p-7y_p)/9\sqrt{2n}+O(1/\sqrt{n})$, and $t_{pn}=y_p+(y_p^3+y_p)/4n+O(1/n)$. The methods used to derive these formulae are also applicable to many other distributions. L. S. G.

519.271.01 1231

On the Liapounoff limit of error in the theory of probability. ESSEEN, C. G. *Ark. Mat. Astr. Fys.*, 28*A*, 2, *No.* 9, [19 *pp.*], 1942.

519.283 : 521.11 *see Abstr.* 1234

519.283 : 621.395.66 = 3 1232

Intensity fluctuations in telephone traffic. PALM, C. *Ericsson Techn., No.* 44, [189 *pp.*], 1943.—[Abstr. 1222 B (1944)].

519.34 : 539.2 : 539.15 *see Abstr.* 1379

521.03 1233

Astrophysical research in France in 1940–42. SWINGS, P. *Astrophys. J.*, 99, *pp.* 115–118, *Jan.*, 1944.—Summaries are given of 11 papers in *Ann. d'Astrophysique*, vols. 4 and 5. A. HU.

521.11 : 519.283 1234

The statistics of the gravitational field arising from a random distribution of stars. III–IV. CHANDRASEKHAR, S. *Astrophys. J.*, 99, *pp.* 25–46 *and* 47–53, *Jan.*, 1944.—[See Abstr. 1315 (1943)]. In III the author considers the correlations in the forces acting at 2 points separated by a finite distance in a system containing a random distribution of stars. The central problem is shown to be the evaluation of the average force acting at a point in the same direction as the force acting at another specified point, and the solution is indicated. In IV the stochastic variation of the force acting on a star is studied. The problem here requires the specification of the average force per unit mass F_t acting on a star at time t, given that it was acted on by F_0 at $t=0$. An explicit formula is derived for the correlation coefficient betw. F_0 and t. A. HU.

521.13 1235

Periodic and asymptotic orbits in a five-body problem. BUCHANAN, D. *Canad. J. Res. A*, 22, *pp.* 1–25, *Jan.*, 1944.—The author determines orbits in the vicinity of the 13 libration points in a restricted 5-body problem in which 4 of the bodies are finite and of equal mass, and are fixed at the corners of a square that rotates uniformly about their c.g. The 5th body is infinitesimal and is attracted by the others according to the inverse square law. Asymptotic orbits of 2 dimensions and periodic orbits of 2 and 3 dimensions are obtained. A. HU.

521.35 : 523.842 1236

A method of applying differential corrections to the elements of double-star orbits. HIRST, W. P. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 337–343, 1943.—An impersonal arithmetical method analogous to the van den Bos graphical method is described for applying differential corrections to orbital elements. The method, which is much less laborious than the least-squares method, is applied to the orbit of ADS 16497. A. HU.

522.61 : 535.313 1237

Schmidt systems as spectrograph cameras. MINKOWSKI, R. *J. Opt. Soc. Amer.*, 34, *pp.* 89–92, *Feb.*, 1944.—The advantages and disadvantages of Schmidt spectrograph cameras are discussed. The field curvature is not too much for thin photographic plates in cameras of focal length > 30 in., and for shorter focal lengths a field-flattening lens can be used. The loss of light due to occultation by the plate can be avoided by an off-axis construction; this is satisfactory for large focal lengths with bent plates, but field-flattening lenses are of restricted usefulness with this arrangement, so that some loss of light is inevitable with short-focus off-axis systems. A. HU.

522.614.2 1238

Some remarks concerning the method of measuring line intensities in narrow stellar spectra with a wide slit. ÖHMAN, Y. *Ark. Mat. Astr. Fys.*, 28*B*, 2, *No.* 7, [8 *pp.*], 1942.—The author investigates the effect produced on the measured intensity of an absorption line on a stellar spectrogram by using an analysing aperture longer than the spectrum is wide. It is shown that the ordinary formula holds, except that the effective photographic contrast factor γ is reduced. The result is independent of the type of microphotometer. A minor variation of measured intensity with γ is noted, and the effect of this on measuring unwidened spectra is assessed. A. HU.

523.162.2 : 523.872 1239

Selective absorption near the North Pole and the spectrum/colour relation. SEARES, F. H. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 281–287, 1943.—The contradictions found by Martin [Abstr. 1003 (1943)] in the selective absorption and the colour of A0 stars is attributed to a magnitude error in the Mt. Wilson Polar Catalogue affecting stars brighter than photovisual magnitude 9·2 of types earlier than G0. A revised spectrum/colour relation is obtained and an obscuring cloud extending to 450 parsecs is found, producing a max. colour excess of 0·27 mag. The international colour index for unobscured A0 stars is −0·15 mag. A. HU.

523.341 : 523.39 1240

A map of the lunar crater Conon and suggested work for amateurs. VAUGHN, F. *J. Roy. Astr. Soc. Can.*, 37, *pp.* 393–397, *Dec.*, 1943.—Discrepancies in the measured dia. of this crater are pointed out, and possible explanations are advanced for the modern failure to detect the central peak described by earlier selenographers. A map of the present appearance is given, and a course of observations outlined for amateurs. A. HU.

523.39 : 523.341 *see Abstr.* 1240

523.58 : 525.724 1241

Meteors and the earth's upper atmosphere. WHIPPLE, F. L. *Rev. Mod. Phys.*, 15, *pp.* 246–264, *Oct.*, 1943.—

Observational data on 17 photographic meteors and 433 visual meteors are used in formulae derived for the atmospheric density ρ at 4 points along each trail: near the beginning, at max. light, at the end, and at any point where the retardation is measurable. Systematic deviations betw. the 4 methods are generally $< 0{\cdot}1$ in log ρ, and probable errors of a single determination range from $\pm 0{\cdot}12$ to $\pm 0{\cdot}21$ in log ρ. The height/density curve suggests a flat temperature max. of 375°K. near 60 km., a rapid drop to 250°K. near 80 km. and a const. or slowly rising temperature up to 110 km. A seasonal effect is deduced corresponding to a general rise of $5{\cdot}3 \pm 1{\cdot}0$ km. of the upper atmosphere at midsummer as compared with its midwinter height. A. HU.

523.72 : 525.733 : 551.521.3 1242

The ultra-violet solar radiation in spectral range UVA. AURÉN, T. E. *Ark. Mat. Astr. Fys.*, 28*A*, 3, *No.* 11, [29 *pp.*], 1942.—An ultra-violet pyrheliometer is described in which the visible radiation is removed by glass filters, and the infra-red by a $CuSO_4$ solution. Using American data for the solar energy distribution and atmospheric transmission factors in the region 312–400 mμ, the reduction factors for these filters are calculated. Absolute measurements of the solar radiation in this region at Stocksund during 1941 are described. The complex transmission factors obtained show variations in the forenoon and in warm weather, and tend to rise in the afternoon (air mass > 2). These changes are attributed to alterations in the sizes of suspended water drops in the atmosphere. The mean extra-terrestrial radiation obtained from observations made in good conditions agrees with the American value. A. HU.

523.74 : 550.381 *see Abstr.* 1463

523.746.5 : 621.396.812.5 1243

1944: sunspot minimum year. BENNINGTON, T. W. *Wireless World*, 50, *pp.* 34–36, *Feb.*, 1944.—The effect on radiocommunication of the sunspot min. is reviewed. With the decrease in ionizing solar radiation the critical penetration frequency is reduced and the max. usable frequency falls, with corresponding increases in atmospheric disturbances, and congestion in the longer wavelengths. Little improvement in the conditions is likely till 1946. A. HU.

523.774 1244

The variations in the profiles of strong Fraunhofer lines along a radius of the solar disc. HOUTGAST, J. *Astrophys. J.*, 99, *pp.* 107–114, *Jan.*, 1944.—High-dispersion grating spectrograms, obtained at Utrecht and at Potsdam, from the centre of the Sun's disc and from various points along a radius, are examined with a Moll microphotometer. Profiles of 23 lines of Fe, Mg, Ca, Ca^+ and Na are obtained. Details of the reduction method and the corrections for false light are given. Centre-limb variations are discussed for the central intensities, the inner wings and the far wings. The theory of coherent scattering is inadequate to represent the centre-limb variation in the outer wings, especially of the ultra-violet lines, and it is suggested that non-coherent scattering is the dominant process in the formation of strong absorption lines. A. HU.

523.774 1245

Solar research in Belgium during 1942. SWINGS, P. *Astrophys. J.*, 99, *pp.* 118–120, *Jan.*, 1944.—A summary is given of a paper by Migeotte describing the application of a self-recording infra-red spectrograph to the solar spectrum betw. 1·35 and 2 μ. The 15 000-line grating gives a resolving power of 10 000, absorption lines 1·5 Å apart being separable. A. HU.

523.774 1246

Note on a further search for polarization in Fraunhofer lines at the Sun's limb. REDMAN, R. O. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 329–330, 1943.—Previous work [Abstr. 2273 (1941)] is repeated by an improved method. The small positive effect found then in λ4 227 is not confirmed, nor do any other Fraunhofer lines examined show any greater polarization at the limb than at the centre of the disc. A. HU.

523.775 1247

Preliminary note on the behaviour of helium in the solar atmosphere. DIJKE, S. E. A. VAN. *Astrophys. J.*, 99, *pp.* 121–123, *Jan.*, 1944.—The author reviews present data on the appearance of the He lines in absorption or emission over various disc phenomena. The occurrence of lines of such high excitation potential is possibly due to population of the metastable 2^3S level by recapture of electrons by photo-ionized He atoms. Metastable He atoms then behave as if they had an ionization potential of only 4·67 eV, and the triplet lines are produced. A classification of solar flares based on the behaviour of the He lines is suggested as more sensitive for terrestrial correlations than the present Hα classification. A. HU.

523.821.3 1248

Standard magnitudes at $-45°$ declination. STOY, R. H. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 288–328, 1943.—The procedure used in obtaining photographic and photovisual magnitudes for 250 standard stars of magnitude 7–10 in the Harvard E regions is described. The provisional magnitudes are reduced to the international system by comparisons with stars in the Pleiades, the Hyades and Praesepe. The final magnitudes have an external probable error of $\pm 0{\cdot}05$ mag. but an internal consistency much better than this. Formulae are given for reducing the Harvard and Cape Astrographic photographic magnitudes to the international system. Re-observation of the $-30°$ to $-35°$ zone yields magnitudes on this system for 3 000 stars of known spectral type. The colour indices of these stars show a variation with apparent magnitude which is biggest for the cooler stars. A. HU.

523.841.35 1249

Spectroscopic observations of AX Persei, RW Hydrae, CI Cygni, and Z Andromedae. MERRILL, P. W. *Astrophys. J.*, 99, *pp.* 15–24, *Jan.*, 1944.—Data on the intensity and displacements of the chief bright lines (due to H, He, O and Ne) in the blue-violet region of the "combination" spectra of these stars are given and discussed. The displacements of most lines, especially forbidden ones, are variable, the range being about 30 km./sec., and the period 1 to 3 years. The phase of the variation in the forbidden lines lags by $^1/_5$ of the period behind that of the permitted lines. A. HU.

523.841.9 : 523.872 125(

The ultra-violet spectrum of VV Cephei. STRUVE, O. *Astrophys. J.*, 99, *pp.* 70–74, *Jan.*, 1944.—A list is

given of wavelengths, intensities and identifications of emission and absorption lines in the spectrum of this eclipsing binary betw. 3 277 Å and 3 771 Å. Many metallic emission lines are flanked by narrow absorption lines on their red sides, their appearance resembling the H lines. There is little or no Balmer discontinuity in the continuous spectrum, suggesting that much of it is produced by the emitting shell. It is probable that the ultra-violet absorption features are produced largely in front of the blue component, so that, since $^1/_4$ revolution has passed since mid-eclipse, the shell may envelop the whole system. A. HU.

523.841.9 : 523.872 1251

The spectrum of SX Cassiopeiae. STRUVE, O. *Astrophys. J.*, 99, *pp.* 89–102, *Jan.*, 1944.—The velocity curve of this eclipsing binary is derived from 42 spectrograms secured during 3 consecutive cycles in 1943. The curve is very unsymmetrical; it is not entirely self-consistent and gives elements inconsistent with the light curve. It is concluded that the observed velocity is not wholly due to orbital motion, but that a substantial portion arises from streams of gas which at certain phases are seen projected on the disc of the bright A star. The nature of the streaming needed to produce the observed effects is deduced in detail. It probably occurs in a tenuous shell whose existence is confirmed by the dilution effect which causes λ4 481 to be abnormally weak. Irregular variations in the velocity curve are probably due to density changes in the gas streams, which may also account for a large scatter in the photometric observations. A. HU.

523.842 1252

On the stability of binary systems. CHANDRASEKHAR, S. *Astrophys. J.*, 99, *pp.* 54–58, *Jan.*, 1944.—The theory of spatial correlations [Abstr. 1234 (1944)] is used to derive a formula for the time of dissolution of a binary star by the effect of the locally fluctuating gravitational field. This time, for binaries of semi-major axes in the range 10^3–10^4 astronomical units, is betw. 7×10^{10} and 2×10^9 yr. Since the distribution of energies in binary systems does not conform to Boltzmann's law, it is concluded that the time scale of the Galaxy is in the neighbourhood of 3×10^9 yr. The data of double-star astronomy thus do not support the long time-scale hypothesis. A. HU.

523.842 : 521.35 *see Abstr.* 1236

523.842.2 1253

Double-star measures. HIRST, W. P. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 331–336, 1943.—Separations and position angles are given for southern double stars observed with the 7 in. refractor at the Cape. A. HU.

523.842.2 1254

The orbit of Melb. 4 AB. HIRST, W. P. *Mon. Not. Roy. Astr. Soc.*, 103, 6, *pp.* 344–347, 1943. A. HU.

523.852.21 ; 523.874 *see Abstr.* 1259

523.854.12 1255

Colours of early-type stars in the southern Milky Way. HEYDEN, F. J. *Astrophys. J.*, 99, *pp.* 8–14, *Jan.*, 1944.—Colour excesses for 157 bright stars of early type are computed from a recent list [Abstr. 27 (1943)] of colour indices. The stars lie in the southern Milky Way betw. galactic long. 215° and 330°, but only 19 show significant reddening. It is concluded that space absorption here is small out to 250 parsecs, except in the region of the η Cari nebula, in the Coal Sack, and near the Scorpio cluster. In the latter region the obscuration reaches 2 mag. in 300 parsecs. A. HU.

523.872 1256

Note on the cyanogen absorption at λ3 883 in the spectra of late-type stars. GRÖNSTRAND, H. O. *Ark. Mat. Astr. Fys.*, 28*A*, 4, *No.* 16, [10 *pp.*], 1942.—Microphotometer tracings of the spectra of 35 late-type stars are measured at the *K* line, at the densest part of the 3 883 Å absorption, and at 3 comparison regions. The intensity of the CN absorption at 3 883 Å is correlated with luminosity, but less so than is that at 4 216 Å ordinarily used; only betw. spectral classes G5 and K2 can it be used as a criterion of abs. magnitude. The intensity of the *K* line correlates fairly closely with the drop of intensity in the continuum betw. 4 025 Å and 3 907 Å, this latter quantity being itself a colour equivalent. A. HU.

523.872 1257

Notes on stellar spectra. STRUVE, O. *Astrophys. J.*, 99, *pp.* 205–209, *March*, 1944.—Lines in the spectrum of the P Cygni star HD 169226 show a large range of radial velocities, with no obvious relation to ionization potential, from − 143 km./sec. for H absorption to + 141 km./sec. for He I emission. The variable shell spectrum of HD 217050 is described, and the effect of continuous H absorption within the shell in suppressing the ultra-violet lines of all elements except Ni is pointed out. The colour of HD 160529 is found to be similar to that of a late F or early K star in spite of its A4 spectrum; its H lines and Balmer discontinuity are weak. Spectrograms of Pleione show that its shell is evolving towards lower ionization. Changes in the spectra of AG Pegs and Z Andr are noted. A. HU.

523.872 : 523.162.2 *see Abstr.* 1239

523.872 : 523.841.9 *see Abstr.* 1250, 1251

523.872 : 535.343.4 1258

The continuous absorption coefficient of the negative hydrogen ion. HENRICH, L. R. *Astrophys. J.*, 99, *pp.* 59–69, *Jan.*, 1944.—An 11th-order Hylleraas wave function for the ground state of H^- is determined, minimizing the energy in accordance with the Ritz principle and using the convergency criterion of Chandrasekhar and Krogdahl [Abstr. 137 (1944)]. The continuous absorption coefficient is calculated, using the new wave function, and given in tabular form: it has a max. at 7 500 Å about 30% higher than the previously accepted max., which was at 4 750 Å. The new absorption coefficient considerably reduces the discrepancy betw. observed and calculated colour temperatures and effective temperatures. A. HU.

523.874 : 523.852.21 1259

Radial velocities of the four stars of the trapezium in Orion. STRUVE, O., AND TITUS, J. *Astrophys. J.*, 99, *pp.* 84–88, *Jan.*, 1944.—Radial velocities of the 4 components of θ^1 Orio are measured on 76 spectrograms. One is a spectroscopic binary of period 6·5 days and velocity range 160 km./sec., but the other 3 show little velocity variation. The mean velocity of these 4 stars

and of θ^2 Orio exceeds the velocity of the Orion nebula, in which they appear immersed, by 15 km./sec. This may be due to a gravitational red shift or to a systematic motion of the stars through the nebula. A. HU.

523.877 1260

On the inversion of density gradient and convection in stellar bodies. SEN, N. R. *Proc. Nat. Inst. Sci., India*, 7, 2, *pp.* 183–196, 1941.—A method which makes use of the thermodynamic properties of polytropes with variable indices is employed to investigate the conditions under which, for a given opacity formula and a given law of energy generation, radiative and convective transfer of energy, respectively, are associated with an outward positive density gradient. The conditions are applied in particular to stellar models in which the energy is generated by Bethe's mechanism. A. HU.

523.877 1261

On a stellar model built in complete accordance with Bethe's formula of energy generation. SEN, N. R., AND BURMAN, U. R. *Phys. Rev.*, 64, *p.* 317, *Nov.* 1 *and* 15, 1943.—[See Abstr. 2026 (1941), 1260 and 1262 (1944)].

523.877 1262

On stellar models based on Bethe's law of energy generation. SEN, N. R. *Proc. Nat. Inst. Sci., India*, 8, 2, *pp.* 317–330, 1942.—Stellar models are discussed in which Bethe's mechanism generates energy in a core surrounded by a radiative envelope where the luminosity is const. and the opacity $\propto$ (density)^a (temperature)$^{-b}$. Finite configurations are possible only when $b < 4a$. Generally, for all positive values of a and b there are solutions which ultimately correspond to isothermal gas spheres of infinite mass and radius and non-zero limiting temperature. [See Abstr. 1260 (1944)]. A. HU.

523.877 1263

Contribution to the theory of stellar models. SEN, N. R. *Proc. Nat. Inst. Sci., India*, 8, 3, *pp.* 339–360, 1942.—The author examines the dimensions and convective stability of stellar models in which the energy generation $\propto$ (density)$^\alpha$ (temperature)$^\delta$. Only the standard solutions represent finite configurations. The conditions in which the various models are radiatively stable are derived. A. HU.

525.61 1264

Contributions to the analytical theory of tides. OSEEN, C. W. *Ark. Mat. Astr. Fys.*, 28*A*, 2, *No.* 10, [43 *pp.*], 1942.—A mathematical paper continuing previous work [Abstr. 3473 (1937)]. A. HU.

525.622 : 526.775 1265

The periodic variations of the gravitational force. I. LOCKENVITZ, A. E. *Geophysics*, 9, *pp.* 94–105, *Jan.*, 1944.—The expression for the variation of the gravitational field, at a particular place on the earth's surface, due to a tide-producing body is put into a form which does not neglect terms or factors which will produce changes in the gravitational field of 0·001 milligal. A method of carrying out routine calculations by means of a series of graphs is described.

525.724 : 523.58 *see Abstr.* 1241

525.733 : 551.521.3 : 523.72 *see Abstr.* 1242

525.75 : 551.510.535 1266

A comparison of the variations of night-sky luminescence and of region-F electron density at night. GHOSH, S. N. *Sci. and Cult.*, 9, *pp.* 170–172, *Oct.*, 1943.—The lack of correlation betw. F-layer electron density at night and the intensity of night-sky emission is attributed to the fact that, whereas the ionospheric measurements refer to the region of max. ionization, the optical phenomena depend on the total number of ions present in the region. If Mitra's reaction [Abstr. 2685 (1943)] betw. N_2^+ and O^- is accepted, the intensity of emission will be far less variable than the max. ion density, as is in fact observed. A. HU.

526.775 : 525.622 *see Abstr.* 1265

53 : 547.2 : 541.6 *see Abstr.* 1434

53.08 : 796 1267

Bad physics in athletic measurements. KIRKPATRICK, P. *Amer. J. Phys.*, 12, *pp.* 7–12, *Feb.*, 1944.—This article examines the errors afflicting measurements in field sports, associated with fictitious precision and bad metrology. Particular consideration is given to the error pertaining to the variation of the force of gravity in relation to the throwing of a projectile, and a correction chart is given. The effects of terrestrial rotation are also considered in the same connection, and further correction curves are given for rendering throws in various directions comparable. A. E. T.

530.145 : 538.112 = 3 *see Abstr.* 1369

530.145.63 : 537.12 = 4 *see Abstr.* 1342

531.1 : 513.738 *see Abstr.* 1219

531.224.4 1268

Creep and bending moments in a non-uniform column. HAWKEN, R. W. H. *J. Instn Engrs Aust.*, 15, *pp.* 230–231, *Nov.–Dec.*, 1943.—The effect of creep in timber is reflected in the value to be allowed for the eccentricity or other departure from perfect straightness and/or centrality. The extra deflections caused by the axial load depend on E, but the effect of creep on E is negligible. The net effects of creep are set down as a virtual shape, the final deflected form of which may be obtained by a procedure which is summarized. G. E. A.

531.35 1269

An experiment illustrating centripetal force. MILLER, P. H., JR. *Amer. J. Phys.*, 12, *pp.* 40–41, *Feb.*, 1944.

531.383 1270

Precession of a magnetic top. RADO, G. T. *Amer. J. Phys.*, 12, *pp.* 29–31, *Feb.*, 1944.—A simple demonstration experiment to show the fundamental relationship between the precession of a rapidly spinning gyroscope and the external torque.

531.62 1271

An elementary conservation-of-energy experiment. COLLINS, E. H. *Amer. J. Phys.*, 12, *pp.* 44–45, *Feb.*, 1944.

531.72 : 536.658 1272

Surface areas of porous materials calculated from capillary radii. HARVEY, E. N., JR. *J. Amer. Chem. Soc.*, 65, *pp.* 2343–2346, *Dec.*, 1943.—Equations have been developed which permit calculation of the surface areas of porous adsorbents from the h.p. portion

of adsorption isotherms. When the adsorbed layer is taken into consideration and when the desorption isotherm is used, pore radii give surface areas in agreement with those obtained by the Point B method of Emmett and Braunauer. A tabulation of results by both methods is included.

532.13 : 669.715 1273

The viscosity of aluminium-silicon alloys. POLIAK, E. W., AND SERGUEIEV, S. W. *C.R. (Doklady), Acad. Sci. URSS*, 33, 3, *pp.* 244–247, 1941.—Describes measurements of the viscosity of molten Al-Si alloys in the range of conc. of 0·25% to 19% Si, using the oscillating-sphere method. The results show a marked increase in viscosity corresp. to the range of solid solutions, and an equally marked decrease corresp. to the eutectic alloy (11·7% Si). Measurements were also carried out on the eutectic alloy (Silumin), after being refined to various degrees by the addition of metallic Na and a mixture of NaF and NaCl. The refining process increased the viscosity considerably, although it decreased again with time. The significance of the results is discussed.

A. E. T.

532.133 : 532.14 : 541.66 1274

Viscosities of unsaturated six-membered isocyclic compounds. FRIEND, J. N., AND HARGREAVES, W. D. *Phil. Mag.*, 35, *pp.* 136–142, *Feb.*, 1944.—Data tabulated and plotted show the effect on viscosity and density of the progressive conversion of C_6H_{12} to C_6H_6 [Abstr. 356 (1944)]. of the formation of C_6H_6 derivatives by the introduction of NO_2, NH_2, OH, and other groups, and of various substituent groups in the phenyl ethers. The rheochor of the phenyl group attached to alkyl groups has the mean val. 100·7; replacement of H in C_6H_6 by an electronegative group yields a higher val. for the phenyl group, rising from 101·4 in $C_6H_5NO_2$ to 105·4 in C_6H_5I. N. M. B.

532.133 : 679.5 : 532.712 *see Abstr.* 1281

532.14 : 541.66 : 532.133 *see Abstr.* 1274

532.542 1275

Instructional apparatus for studying pipe flow. BINDER, R. C. *Amer. J. Phys.*, 12, *pp.* 41–43, *Feb.*, 1944.

532.57 : 621.317.39 1276

Electromagnetic velometry. I. A method for the determination of fluid velocity distribution in space and time. KOLIN, A. *J. Appl. Phys.*, 15, *pp.* 150–164, *Feb.*, 1944.—[Abstr. 1144 B (1944)].

532.612 1277

Minima in surface-tension/concentration curves of solutions of sodium alcohol sulphates. MILES, G. D., AND SHEDLOVSKY, L. *J. Phys. Chem.*, 48, *pp.* 57–62, *Jan.*, 1944.—Precision measurements with highly purified substances indicate that the unexplained min. can be produced (1) when 2 surface-active materials, 1 of which is only slightly soluble in water and is highly adsorbed, are present, or (2) by mixing 2 anionic surface-active electrolytes. N. M. B.

532.612.4.08 : 541.265 : 547.233 1278

The surface tensions and parachors of the methyl and ethyl amines. SWIFT, E., JR., AND CALKINS, C. R. *J. Amer. Chem. Soc.*, 65, *pp.* 2415–2417, *Dec.*, 1943.—The surface tensions of the methyl and ethylamines were measured at 15°, 25° and 35°, with an accuracy of 0·5%, by the capillary-rise method. The parachors do not indicate any structural abnormalities in the liquid state.

532.691 : 547.21 1279

Effect of electrolytes on the surface activity of solutions of paraffin chain salts. AICKIN, R. G., AND PALMER, R. C. *Trans. Faraday Soc.*, 40, *pp.* 116–120, *March–April*, 1944.—A mathematical theory is developed, extending that of Cassie and Palmer [Abstr. 500 (1941)], to explain the differences in the effect of various added ions on the surface activity of anionic detergents, taking account of the charge and size of the ions. N. M. B.

532.71 : 541.133 1280

Discussion and interpretation of the migration data of laurylsulphonic acid in aqueous solution. RYSSELBERGHE, P. VAN. *J. Phys. Chem.*, 48, *pp.* 62–65, *Jan.*, 1944.—McBain's recent migration data for laurylsulphonic acid in aq. solution indicate the probable presence of large amounts of nearly neutral micelles with compensating migrations at conc. above the max. in the transference curve. Below the max. the transference numbers agree with the values calculated on the basis of a previously calculated average micelle whose composition and size change continuously with conc. [See Abstr. 213 (1940)].

532.712 : 532.133 : 679.5 1281

Comparative osmotic and viscosity measurements with polystyrene fractions. ALFREY, T., BARTOVICS, A., AND MARK, H. *J. Amer. Chem. Soc.*, 65, *pp.* 2319–2323, *Dec.*, 1943.—Three samples of polystyrene, prepared by polymerization of the pure monomer at 60°, 120° and 180°, were fractionated. The sp. viscosities were measured at 30° and 40° in toluene up to vol. conc. of 1·0%. The intrinsic viscosities and k' constants for all fractions were determined. Osmotic pressures of the fractions were measured and the mol. wt. and μ-const. of these determined. The fractions of each individual sample show very closely the same k' and μ values, while there is a definite difference in these constants from sample to sample. The relationship between $[\eta]$ and M_2 is given by the expression $[\eta] = KM_2^a$; the values for K and a were determined for all three samples.

532.73-1 : 536.7 1282

The structure of water in aqueous solutions. ELEY, D. D. *Trans. Faraday Soc.*, 40, *pp.* 184–194, *May*, 1944.—[See Abstr. 4231 (1939)]. The paper pays particular attention to the rôle played by the polar and structural features of water, and discusses energy and entropy of solution of the inert gases, using the 2-stage process: (*a*) a cavity the size of the gas molecule is made in the water, (*b*) the gas molecule is inserted in the cavity. A molecular theory is given for the low energy of cavity formation, already established using thermodynamic equations. This low-energy term is due to polarization of the water molecules, which will be maintained when an inert gas atom enters the cavity. An inert gas atom can occupy only a certain restricted number of sites in the solvent water. The partial molal heat capacities of ions in aq. solutions are discussed. The long-range order or structure of liquid water must be considered in any theory of the heat capacity of ions.

532.739.2 : 539.378.3 1283

Solubility and diffusion of sulphur in synthetic elastomers. KEMP, A. R., MALM, F. S., AND STIRATELLI, B. *Industr. Engng Chem.*, 36, *pp.* 109–113, *Feb.*, 1944.—Sulphur is more soluble in GR-S than in natural crepe rubber above 55°C. and less soluble below this temperature. The solubility of S in Perbunan, Hycar OR-15 and Butyl B-3 is less than in rubber or GR-S in the order given. The rate of diffusion of S through elastomers decreases in going from natural crepe rubber to Buna S to Hycar OR-15 to Butyl B-3.

532.782 1284

One-phase or two-phase conditions in the system Fe-Ni: theories of meteoric iron and invar. BENEDICKS, C. *Ark. Mat. Astr. Fys.*, 28*A*, 3, *No.* 14, [32 *pp.*], 1942.—Artificial Fe-Ni alloys of the nature of invar are shown to consist of 2 phases corresponding to kamacite and taenite in meteorites. The contraction caused by the transition betw. these phases compensates the normal expansion. No plausible equilibrium diagram can yet be drawn, however, but it is found that the mutual solubility of the 2 phases is increased by the presence of foreign substances. A quantitative examination is made of the volume anomaly near the composition Fe_2Ni, and of the anomalies in the elasticity and resistivity. The 2-phase theory of invar is considered as established. A. HU.

533.15 1285

Gaseous diffusion as a tool for locating critical points in metals and alloys. COLEMAN, H. S., AND YEAGLEY, H. L. *J. Appl. Phys.*, 15, *pp.* 125–127, *Feb.*, 1944.

533.15 : 539.219.1 *see Abstr.* 1387

533.15 : 539.219.1 : 541.127 1286

Kinetics of formation of zeolitic solid solutions. BARRER, R. M., AND IBBITSON, D. A. *Trans. Faraday Soc.*, 40, *pp.* 206–216, *May*, 1944.—A study of the velocity of the sorption processes [Abstr. 1387 (1944)]. The influence of gas pressure, temperature, state of subdivision and conditions of outgassing of the zeolite, were investigated quantitatively and found to have a great effect upon the rates of occlusion. Observations made earlier on sorption velocities include measurements of the diffusion const. [Abstr. 4034 (1934)] and of sorption rates [Abstr. 3973 (1938)]. These measurements were confined to the polar molecules NH_3 and H_2O. The present study, using chabazite and active and inactive analcite, is extended to non-polar chain molecules.

533.16 : 533.7 1287

The variation of the viscosity of gases and vapours with temperature. LICHT, W., JR., AND STECHERT, D. G. *J. Phys. Chem.*, 48, *pp.* 23–47, *Jan.*, 1944.—For 24 representative gases and vapours at atm. pressure Sutherland's equation fits extensive experimental data with an error of $< 1\%$ over a wide range of temperature. For H and He, Trautz's equation holds. Methods of treating experimental data to evaluate the constants in the 2-const. equations are developed. Values of K and C in Sutherland's equation and b and d in Trautz's equation are determined. For estimating values of viscosity when no experimental data are available, a universal viscosity/temperature function is developed.

533.6.07 1288

Transparent plastic wind tunnel for fan testing. *Engineering*, 157, *p.* 247, *March* 31, 1944.—The tunnel is constructed of Perspex tubes joined co-axially to 25 ft. length, 30 in. dia. internally. The inlet flare is 6 ft. dia. and air drawn in is first passed through a honeycomb built up of 10 mm. hexagonal tubing, the object of which is to ensure a uniform flow.

533.662 : 629.12.037 *see Abstr.* 1494

533.7 : 533.16 *see Abstr.* 1287

534.131 1289

On the elastic vibrations of cylindric shells. EPSTEIN, P. S. *Bull. Amer. Phys. Soc.*, *Dec.* 6, 1943.—A method of treating elastic shells permits of obtaining the solution, which was worked out for shells having the shape of circular cylinders. The 3 types of border conditions, clamped edges, free edges, and supported edges, lead to the same characteristic frequencies. But the character of the oscillations is not the same for clamped as for free edges.

534.22 1290

The Doppler and echo Doppler effect. PERRINE, J. O. *Amer. J. Phys.*, 12, *pp.* 23–28, *Feb.*, 1944.—Records an occasion on which an observer on a car and a puffing train approached each other rapidly on parallel ways. The puffs of the engine were seen and heard, and the frequency of the puffs as heard was noticeably different from the frequency as observed by eye. The author then sets out 16 cases of the Doppler effect involving motion of generator, detector and reflector, and, after solving each case separately, finds a combined formula adaptable to all 16 cases.

G. E. A.

534.222.2 : 541.126 1291

Mechanism of detonation in explosives. LAWRENCE, R. W. *Geophysics*, 9, *pp.* 1–18, *Jan.*, 1944.—Results of photographic work on the detonation of high explosives are presented and discussed rel. to hydrodynamic theory. Methods for determining strength and detonation velocity are described. The photographs illustrate the nature of detonation waves in explosives and of shock waves in air. The duration of the detonation waves in nitro-glycerin and blasting gelatin is $< 10^{-6}$ sec. and the duration of the shock waves in air is of the same order. The high temperature of shock waves predicted by theory is confirmed. Photographs are included showing the propagation of detonation from one cartridge of blasting gelatin to another across air gaps and water gaps. In the latter case, no visible shock wave is produced in the water and the highly luminous after-burning is eliminated. Calculations indicate that pressures in the detonation wave may run to 140 000 atm. and temperatures to 4 300°C. The shape of the detonation wave front in a high-velocity explosive is planar, whereas in low-velocity explosives it is convex.

534.24 : 534.647 1292

Frequency discrimination in the low-velocity zone. SHUGART, T. R. *Geophysics*, 9, *pp.* 19–28, *Jan.*, 1944.—Theoretical discussion of the frequency discrimination due to multiple reflections of low-velocity waves in the zone underlying the seismic pick-up. Three media or zones are considered, separated by plane interfaces through which plane waves move in a

ormal direction. For a given thickness, the transmission is a function of the frequency, and the ratio of the max. to the min. energy transmission is nearly = the square of the ratio of the spec. impedance of the high-velocity material to that of the low-velocity. The phase lag caused by the weathered layer is a non-linear function of the layer thickness for any given frequency. G. E. A.

534.372 : 621-752.2 1293

The problem of reduction of vibrations by use of materials of high damping capacity. GEMANT, A. *J. Appl. Phys.*, 15, *pp.* 33–42, *Jan.*, 1944.—Since high-quality material has also low internal friction, the author suggests 2 ways of overcoming unwanted vibrations in machinery parts: the use of a material whose decrement generally is low but rises rapidly as the stress increases; and the use of a material whose damping capacity is low but rises to high peaks in certain frequency ranges. Calculations are made on the vibrations of turbine blades and of crankshafts in engines, to show how the suggested methods would work out in practice. G. E. A.

534.647 : 534.24 *see Abstr.* 1292

534.75 : 612.85 = 3 1294

The ear and hearing, a basis of news-transmission technique. FURRER, W. *Bull. Ass. Suisse Élect.*, 34, *pp.* 659–666, *Nov.* 3, 1943.—A lecture on the structure, functions and properties of the ear, giving the results of much recent research. The propagation of a stimulus along a nerve is primarily a chemical process with secondary electrical effects, and is compared with the process in a lighted fuse. The time taken for the nerve to recover is of the order of 1 msec., during which time the chemical process is reversed. If the ear were more sensitive than it is, the Brownian motion would become audible, and with greater sensitiveness at l.f. the processes of blood circulation and of digestion would also be heard. The principles underlying the measurement of loudness, the presence of subjective overtones and the effect of masking, are explained. The residuum, in which frequencies $<$ 300, as in men's voices, are often not transmitted by telephone, is capable of forming the fundamental in the listener's ear. G. E. A.

534.771 : 612.85 : 621.317.39 1295

Apparatus and technique for measurement of vibratory threshold and of vibratory "adaptation" curve. ARING, C. D., AND FROHRING, W. O. *J. Lab. Clin. Med.*, 28, *pp.* 204–207, *Nov.*, 1942.—An improved pallesthesiometer (Laidlaw and Hamilton, *Bull. Neurol. Inst. N.Y.*, 6, p. 494, 1937) for the quantitative measurement of vibratory appreciation is described and illustrated. C. J. G.

534.832 : 621.83 1296

The production of high-speed helical gears, with special reference to the elimination of transmission noises. COULING, S. A. *Proc. Instn Mech. Engrs, Lond.*, 150, 5, *pp.* 172–194, 1943. *BTH Activ.* [*Brit. Thomson-Houston*], 18, *pp.* 22–32, *April*, 1943. *Abstr. in Engineer, Lond.*, 175, *pp.* 98–100, *Jan.* 29, *and pp.* 119–120, *Feb.* 5, 1944.—[Abstr. 1274 B (1944)].

534.838 : 612.8 1297

Human susceptibility to vibration. POSTLETHWAITE, F. *Engineering*, 157, *pp.* 61–63, *Jan.* 28, 1944.—After correlating different forms of vibration tests to which persons have been subjected from time to time, the author concludes that human response to vibration is similar to human response to sound. A family of curves is drawn, plotting applied acceleration in ft./sec.^{2} *v.* frequency of the vibration. The curves are drawn for comparison along with the family of curves for 0, 10, 20 . . . phons. G. E. A.

535.23-1 : 66.046 1298

A new field for infra-red radiation. REAVELL, A. *Industr. Chem.*, *pp.* 119–130, *March*, 1944.—Fundamental principles rel. to wavelength and energy distribution in atomic and molecular structures and in black-body radiation are reviewed. Types of infra-red generators for practical use, and their characteristics, are given and costs considered. The application of infra-red heating to evaporation and distillation of liquids is discussed and an account given of Martin's apparatus. The infra-red evaporator can be constructed to give a satisfactory rate of evaporation at low temperatures, and solutions of penicillin, blood sera and insulin, have been evaporated successfully. M.-V.

535.231 1299

The emissivity characteristics of hot metals, with special reference to the infra-red. PRICE, D. J., AND LOWERY, H. *J. Iron Steel Inst.*, [24 *pp.*], *March*, 1944. *Advance copy.*—A critical review of the subject which discloses the need for further information regarding iron and steel and suggests researches which should meet these needs. Available data appears to indicate, for all substances, a zero temp. coeff. of emissivity at a specific wavelength (for each substance) in the infra-red region. In this region the emissivity correction to a pyrometer reading would be simplified. R. W. P.

535.241.33 : 771.534.5 : 621.316.75 1300

A sensitometer for testing process materials. BERG, W. F. *Photogr. J.*, 84, *pp.* 57–60, *March*, 1944.—A regulator was built which keeps the amount of light fed from an arc lamp into an integrating sphere via a system of mirrors const. within $< \pm$ 10%. The regulator consists of a vane attached to a m.c. instrument without restoring-springs, which is connected in parallel to a barrier-type photocell and a const. e.m.f. If the illumination in the cell changes, the vane moves in a direction appropriate to bring the illumination back to a std. value. The amount of light available from a small hole in the integrating sphere is adequate to expose process materials through a step wedge satisfactorily within 30 sec. Photo-electric and photographic tests show that the quantity and quality of the light is sufficiently const. for practical use.

535.243 : 541.132.3 *see Abstr.* 1424

535.247.4 1301

Portable decade photometer for determination of blood-volume with the dye T-1824. NICKERSON, J. L. *Rev. Sci. Instrum.*, 15, *pp.* 69–72, *March*, 1944.—A photometer for measuring the optical density of a specimen of dyed serum by comparison with a double series of plastic filters covering the range 0·30 to 1·79 in steps of 0·01 density. Since the dye is blue, the filters are made of a blue transparent plastic. J. W. T. W.

535.313 : 522.61 *see Abstr.* 1237

535.33 : 537.531 *see Abstr.* 1357, 1358

535.33.03 : 535.331 : 545.822 1302

Spectrochemical analysis of metals with the multi-source unit. HASLER, M. F., AND KEMP, J. W. *J. Opt. Soc. Amer.*, 34, *pp.* 21–32, *Jan.*, 1944.—The multi-source makes available spark-like sources with moderate sensitivity and high precision, arc-like sources with high sensitivity and good precision, and a wide variety of intermediate sources by means of which reasonable compromises between precision and sensitivity can be effected. The use of the multi-source for the analysis of alloys of Fe, Al, Mg, Zn and Cu-Al is described. A. H.

535.33.03 : 537.523.5 1303

The measurement of spectral intensities in the direct-current arc. HAMPTON, R. R., AND CAMPBELL, H. N. *J. Opt. Soc. Amer.*, 34, *pp.* 12–20, *Jan.*, 1944.—In view of the better reproducibility which is claimed for the condensed spark and a.c. arc, a study is made of certain arc variables with reference to the reproducibility of spectral-intensity measurements. The variables studied include electrode size and shape, region of the arc from which light is taken, arc gap length and arc current. Standardizing these factors, it is claimed that a precision as high as that by other methods is obtained. A. H.

535.33.03 : 545.82 1304

Accessory equipment for spectrochemical analysis. SAUNDERSON, J. L., AND CALDECOURT, V. J. *J. Opt. Soc. Amer.*, 34, *pp.* 116–120, *Feb.*, 1944.

535.33.03 : 545.822 : 669.14 1305

The spectrographic flat-surface sparking technique of steel analysis. GUETTEL, C. L. *J. Opt. Soc. Amer.*, 34, *pp.* 41–46, *Jan.*, 1944.—Full details are given of a spectrographic routine testing laboratory method of steel analysis involving sparking to a flat surface. The elements determined are Mn, Cr, Ni, Si, Mo, V, Al, Cu, Zr. A. H.

535.33.03 = 3 1306

Investigations on rapidly changing spectra. MAEDER, D. *Helv. Phys. Acta*, 16, 6, *pp.* 503–528, 1943.—A rotating mirror and optically synchronized impulse producer is used. The time-resolution obtainable (up to 10^{-5} sec.) which is considerably greater than that of mechanical apparatus, is discussed. Experiments with the vapours of $AlBr_3$ and BCl_3 show that immediately after the passage of the discharge there is a strong ultra-violet absorption corresponding to the radicals AlBr and BCl, with a life period of the order of 0·01 sec. A corresponding absorption could not be detected with $HgCl_2$, probably owing to the short life of the HgCl radical, which is estimated to be approx. 10^{-5} sec. A weak absorption due to SiCl was obtained from $SiCl_4$. A. J. M.

535.33.071 1307

The lithium fluoride prism in infra-red spectroscopy. WRIGHT, N. *Rev. Sci. Instrum.*, 15, *pp.* 22–27, *Feb.*, 1944.—Coverage of the spectral range from 2 to 5·9 μ with higher resolving power than that obtainable with rocksalt is demonstrated. Reproductions of the spectra of several hydrocarbon compounds are included, which show the high degree of resolution obtained. The methyl-group band at 3·37 μ is use as an illustration of the value of the apparatus in th study of molecular structure. This group is abser in polystyrene. LiF is inferior to fluorite onl because it limits observations to wavelengths < 5·9 μ

535.33.072 130

A 21-foot multiple-range grazing-incidence spectro graph. MACK, J. E., AND ANDERSON, E. E. *Rev. Sc Instrum.*, 15, *pp.* 28–36, *Feb.*, 1944.—A spectrograp with wavelength ranges 0–470 Å and 0–2 100 Å described. The use of a single photographic plat 154 cm. long, coated on commercial polished plat glass, and a cylindrically ground cast plate holde makes the dispersion curve smooth and close to th calculated one. Descriptions are given of the me chanical structure, the optical system and the metho of focusing, and the electrical system, incl. a 3 μF 70 kV capacitor.

535.33.072 : 669.1 130

An application of the spectrograph to the inspectio of fabricated iron and steel. KINCAID, H. F. *J. Op Soc. Amer.*, 34, *pp.* 141–146, *March*, 1944.—Describe the spectrographic apparatus and technique employe for inspecting iron and steel using the flat-surfac technique [see Abstr. 86 (1942)]. It is emphasize that reproducibility of results is due primarily t (1) air conditioning, giving humidity and tempera ture control of the spectrographic room, (2) a const voltage power supply, (3) use of sufficient pre-burn Speed and economy are greatly assisted by flat-surfac sparking, use of a single internal std. line, and use o a special slide rule for calculations. A. H

535.331 : 545.822 : 535.33.03 *see Abstr.* 1302

535.331 : 545.822 : 546.46 131

Spectroscopic analysis of magnesium alloys. HESS T. M., AND REINHARDT, L. G. *J. Opt. Soc. Amer.*, 34 *pp.* 104–109, *Feb.*, 1944.—Describes the routin method of the Dow Chem. Co.

535.338.1 : 537.531 *see Abstr.* 1359

535.338.3 : 546.48 131

Spectrum of doubly-ionized cadmium. MAZUMDER K. C. *Indian J. Phys.*, 17, *pp.* 229–238, *Aug.*, 1943.— An experimental investigation of the spark spectrum of Cd was made, extending from λ2 200 to 370 Å The lines corresp. to different stages of ionization wer sorted out by introducing inductance in the spar circuit. 134 lines of Cd III are classified, identifyin 29 new terms which consist of $4d^96s$, $4d^95d$ and 7 un designated terms. The term values are calculated b the 5*s*-5*p* and 5*p*-6*s* groups.

535.338.3 : 546.683 131

Methods of determination of absolute intensities o spectral lines. KWATER, G. S. *J. Phys., USSR*, 6, 5 *pp.* 210–217, 1942.—A comparison is made of th results of the measurements of the abs. intensities o the lines of Tl by 3 different methods, that of anomal ous dispersion, the hook method and the magneti rotation of the plane of polarization. Recalculatio of the results of measurements of Tl v.p. by variou investigators show a discrepancy between the equa tion for temperature dependence of Tl v.p. obtaine by Müller and that got by the writer by optica measurements. A. H

535.338.4 : 546.411.1 1313

Band spectrum of ionized calcium hydride in the ultra-violet. GRUNDSTRÖM, B., AND LAGERQVIST, A. *Ark. Mat. Astr. Fys.*, 28*B*, 2, *No.* 8, [3 *pp.*], 1942.—A singlet band degraded towards the violet, whose analysis indicates a $^1\Pi \rightarrow {}^1\Sigma$ transition, with the *Q* head at 2 424 Å, is found in the spectrum of an arc in H_2 between Ca and C electrodes. The experimental conditions and the structure suggest that the emitter is CaH^+. A. HU.

535.338.4-31 : 546.862.6 1314

A new ultra-violet band system of antimony monoxide (SbO). SEN GUPTA, A. K. *Indian J. Phys.*, 17, *pp.* 216–222, *Aug.*, 1943.—A new ultra-violet band system, due to a $^2\Sigma \rightarrow {}^2\Pi$ transition, was photographed under moderately high dispersion in the region $\lambda 2\,910$–$\lambda 2\,450$ in the emission spectrum of SbO. The bands are degraded towards the violet and each band head is itself double. Their vibrational structure analysis shows that the lower state of this new system is identical with that of the other systems already known for the molecule.

535.338.42 : 539.132 *see Abstr.* 1377

535.338.42 : 546.391.2 1315

Infra-red absorption of solid ammonium chloride and ammonium bromide. BECK, C. *J. Chem. Phys.*, 12, *pp.* 71–78, *March*, 1944.—Fine structure in the 5·6 μ vibrational band of NH_4Cl and NH_4B was resolved. This structure was of the order of magnitude expected if the NH_4 group rotating in the molecule were responsible for the fine structure. The fine structure existed unaltered down to — 20°C. There was considerable change betw. — 20°C. and — 45°C., but then the altered fine structure persisted down to at least — 60°C.

535,338.42 : 547.213/.214 1316

Interpretation of vibrational spectra of propane and butane. ELIASHEVICH, M., AND STEPANOV, B. *C.R. (Doklady) Acad. Sci. URSS*, 32, 7, *pp.* 481–485, 1941.—Describes an application of the general method for the calculation of vibrational frequencies of polyatomic molecules, given in an earlier paper (27, p. 604, 1940). Calculations were made for methane and ethane and their deuterium derivatives, and compared with experimental values. The frequencies of propane and butane were calculated with the aid of the known set of force constants. Good agreement with experimental values was obtained, leading to a definite identification of most frequencies.

A. E. T.

535.338.42 : 548.0 : 536.631 1317

Frequency spectrum of crystalline solids. III. Body-centred cubic lattices. MONTROLL, E. W., AND PEASLEE, D. C. *J. Chem. Phys.*, 12, *pp.* 98–106, *March*, 1944.—[See Abstr. 156 (1944) Erratum, *ibid.*, p. 111]. A study of the dynamics of a Born–Karman atomic model of a body-centred cubic lattice developed with the assumption that only interactions between nearest and next nearest atomic neighbours are significant. The equations of motion of these systems are derived and the secular equations are given from which one can calculate the frequencies of the crystal's normal modes of vibration. From the secular equations the moments of the frequency spectrum are determined and by solving the moment problem, the frequency spectrum itself is obtained as a function of the force constants of the lattice. There are 2 max. of approx. equal height. Asymptotic expressions are derived for the sp. ht. of a body-centred cubic lattice which are valid at high and low temperatures.

535.341 : 537.531 *see Abstr.* 1360

535.343 : 535.372 *see Abstr.* 1321

535.343-31 : 547.5 1318

The ultra-violet absorption spectra and resonance in benzene derivatives—sulphanilamide, metanilamide, *p*-aminobenzoic acid, benzenesulphonamide, benzoic acid and aniline. KUMLER, W. D., AND STRAIT, L. A. *J. Amer. Chem. Soc.*, 65, *pp.* 2349–2354, *Dec.*, 1943.

535.343.3 : 541.651.22 1319

Absorption spectra and the structure of pyrethrins I and II. II. GILLAM, A. E., AND WEST, T. F. *J. Chem. Soc.*, *pp.* 49–51, *Feb.*, 1944.—The evidence of absorption spectra on the structure of the unsaturated pentadienyl side chain of pyrethrolone and the pyrethrins is summarized with new data on pyrethrolone enol semicarbazone. The light-absorption evidence on the latter compound confirms the conclusion previously reached [Abstr. 643 (1943)].

535.343.4 : 523.872 *see Abstr.* 1258

535.371 1320

The dependence of the intensity of fluorescence on the composition of a fluorescing solution. ROLLEFSON, G. K., AND DODGEN, H. W. *J. Chem. Phys.*, 12, *pp.* 107–111, *March*, 1944.—The fluorescence of solutions of fluorescein and acridone was studied as a function of the conc. of iodide added with a const. conc. of the fluorescer, and the conc. of the fluorescent substance. In the absence of a quencher, the intensity of the fluorescence is given by a function of the conc. which takes into account the absorption of the exciting light by the solution, the absorption of the fluorescent light, and the quenching by the molecules of the fluorescent substance. [See Abstr. 444 (1942)].

535.372 : 535.343 1321

Fluorescence and absorption spectral data for pterin-like pigments synthesized by the diphtheria bacillus and isolated by chromatographic analysis. CROWE, M. O'L., AND WALKER, A. *J. Opt. Soc. Amer.*, 34, *pp.* 135–140, *March*, 1944.—Fluorescence zones formed on a chromatograph, and spectral data, are reported. Experimental evidence is presented that pterin-like pigments are present in ultrafiltrates of diphtheria toxin, and photographs are given of the crystal structure of some of the yellow fluorescing material recovered. N. M. B.

535.421 1322

Bright diffraction gratings. BABCOCK, H. D. *J. Opt. Soc. Amer.*, 34, *pp.* 1–5, *Jan.*, 1944.—Definite means of control are given for ruling gratings with the light concentrated in a particular order. The ruling diamond is artificially shaped so that the ruling edge is formed by the intersection of 2 convex conical surfaces. Formation of the grooves is by plastic deformation of the ruled surface. The walls of each groove are made flat, one wide and one narrow, and the inclination of the wide side with respect to the surface is so chosen that its specularly reflected ray coincides with the desired diffracted light. The resulting gratings compare favourably with prisms at either high or low dispersion. A. HU.

535.51 : 620.171.5 1323

Studies in three-dimensional photo-elasticity. FROCHT, M. M. *J. Appl. Mech.*, 11, *A10–A16*, *March*, 1944.—[Abstr. 1085 B (1944)].

535.515 : 541.18 = 3 1324

Form-birefringence. FREY-WYSSLING, A. *Helv. Phys. Acta*, 16, 5, *pp.* 437–454, 1943.—The phenomenon of form-birefringence is observed when transitions take place from mixed substances with submicroscopic (micellar) components to those with amicroscopic (molecular) anisodiametric constituents. It is expressed by the fact that the double refraction of the mixed substance is a function of the index of refraction of the solvent or swelling means employed. The relationship for micellar mixed substances is expressed by a hyperbolic min. curve [Abstr. 2188 (1904)], and approximates to a straight line for molecular mixed substances [Abstr. 911 (1938)]. H. H. HO.

535.54 : 548.0 = 3 *see Abstr.* 1450

535.566.2 : 547.458 1325

The optical rotation of cellulose and glucosides in cuprammonium hydroxide solution. REEVES, R. E. *Science*, 99, *pp.* 148–149, *Feb.* 18, 1944.

535.61 1326

A light source for the primary standard of wavelength. HSUEH CHAO-WANG. *Bull. Amer. Phys. Soc., Dec.* 6, 1943.—The red Cd line, 6 438·4696 Å, remains the primary std. In the laboratory of the Cal. Inst. of Technology, a light source of the Michelson type has been constructed for this line. The interferometer spectrograms show that the line is as narrow as, or narrower than, that emitted from the Osira Cd lamp, and is very intense. The lamp produces a satisfactory spectrogram with 30 min. exposure. The intensity can be varied over a wide range by changing the primary voltage of the transformer. Owing to the high intensity, simultaneous observation of the std. line and of lines from another source is possible either by using a half-reflecting mirror, or by placing the latter source in front of the spectrograph slit.

535.653.85 1327

Further study of ω space. SAUNDERSON, J. L., AND MILNER, B. I. *J. Opt. Soc. Amer.*, 34, *pp.* 167–173, *March*, 1944.—An examination of the metric developed by Moon and Spencer [Abstr. 2334 (1943)] and based on the spacing of the Munsell colours. It is concluded that for some purposes the method is not sufficiently accurate; in particular, the distortion at the higher chromas is serious. This may be due to the recommended Munsell values and not to the theory. J. W. T. W.

535.7 1328

Basis of night vision. WALLS, G. L. *Illum. Engng, N.Y.*, 39, *pp.* 93–111, *Feb.*, 1944.—Describes the mechanism of vision and shows how present knowledge throws light on the behaviour of the eye under night conditions. Dark-adaptation, the relative behaviour of the rods and cones, the effect of dosage with vitamin A and other related subjects, are discussed. J. W. T. W.

535.733 1329

Experimental determination of short-wave fundamental colour in man's colour sense. GÖTHLIN, G. F. *J. Opt. Soc. Amer.*, 34, *pp.* 147–158, *March*, 1944.—Discusses the arguments in favour of violet or blue as the third fundamental colour and describes an investigation of the subject. An analysis of the colour thresholds was made for a number of subjects at wavelengths ranging from 460 to 430 mμ and from the results described it is concluded that the short-wave fundamental colour is blue. J. W. T. W.

535.733 1330

Quantitative formulation of colour mixture and chroma discrimination data for dichromats. FRY, G. A. *J. Opt. Soc. Amer.*, 34, *pp.* 159–166, *March*, 1944.—A dichromat can match any colour by a mixture of two spectral primaries, a red and a blue, and the percentage of blue required to match light of wave-length λ is $100/\{1 + 10^{K(\lambda - c)}\}$. The value of K is fairly const. at 0·0465. c varies with different dichromats and a short method for finding it is described. The total number of "just noticeably different" steps in the chroma scale varies for different dichromats. J. W. T. W.

535.8 1331

A new optical bench. BARNES, N. F. *J. Opt. Soc. Amer.*, 34, *pp.* 110–111, *Feb.*, 1944.

536.2 : 621.365 1332

The application of radiant and inductive heating to industrial processes. CONNELL, L. J. C. *G.E.C.J.* [*Gen. Elect. Co.*], 13, *pp.* 10–32, *Feb.*, 1944.—[Abstr. 1174 B (1944)].

536.21 1333

On a problem in heat conduction. TRANTER, C. J. *Phil. Mag.*, 35, *pp.* 102–105, *Feb.*, 1944.—The problem of the heat flow in a semi-infinite annulus, solved for the steady state by Lowan [Abstr. 2344 (1943)], is now solved for this case by the use of a Fourier transformation and for the variable state by the additional use of the Laplace transformation. R. W. P.

536.24 : 536.42 : 551.57 = 3 1334

On heat transfer between air and cold surfaces involving either condensation or evaporation of water. HOTTINGER, M. *Schweiz. Arch. angew. Wiss. Techn.*, 9, *pp.* 366–374, *Dec.*, 1943.—Equations and tabular data are given relating to the heat transfer occurring in several practical cases, both when the surfaces are above and below the dew point of the air. The cases in which the air passes over an ice-coated surface, or a water surface at a temperature above that of the air, are included. Use of the data is illustrated by numerical examples. R. W. P.

536.24 : 536.423 = 3 *see Abstr.* 1337

536.4 + 621.317 + 620.1 1335

The technique of materials testing. OWEN, W. D. *Beama J.*, 50, *pp.* 135–140, *May*; 172–178, *June*; 203–210, *July*; 271–276, *Sept.*; 314–319, *Oct.*, *and pp.* 337–342, *Nov.*, 1943.—[Abstr. 847 B (1944)].

536.413.3 : 666.97 1336

Thermal expansion of concrete aggregate materials. JOHNSON, W. H., AND PARSONS, W. H. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 101–126, *March*, 1944.—Thermal-expansion determinations were made on 123 specimens by the interferometer method from − 20° to + 60°C. Additional measurements were made on crystals of calcite, quartz and feldspar. The

thermal expansivities of most aggregate materials are close to expansivities of hardened Portland cements. Crystal orientation, rock texture and composition, are discussed with regard to their effects on the rel. of the thermal expansion of aggregates to the durability of concrete.

536.42 : 551.57 : 536.24 = 3 *see Abstr.* 1334

536.423 : 536.24 = 3 1337

Evaporation, heat transfer and velocity distribution for two-dimensional and rotational-symmetrical laminar boundary flows. FRÖSSLING, N. *Lunds Univ. Årsskr.*, 36, 4, [31 *pp.*], 1940.—A preliminary account of the theoretical treatment of the problem, tables of numerical coefficients being given to assist in evaluating the equations for various pressure distributions and sizes of surface. It is shown that for large Prandtl numbers the Nusselt nbr. is exactly $\propto$ (the Prandtl nbr.)$^{1/3}$. R. W. P.

536.5 : 629.135 : 621.317.39 1338

Automatic temperature-recording control system. MOORE, M. E. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 809–815, *Nov.*, 1943.—[Abstr. 1145 B (1944)].

536.52 : 621.383 1339

Barrier-layer photo-electric cells for temperature measurement. LAND, T. *J. Iron Steel Inst.*, [31 *pp.*], *March*, 1944. *Advance copy.*—[Abstr. 1200 B (1944)].

536.52 : 621.383 1340

The drift of selenium photo-electric cells in relation to their use in temperature measurement. HALL, J. A. *J. Iron Steel Inst.*, [11 *pp.*], *March*, 1944. *Advance copy.*—[Abstr. 1201 B (1944)].

536.63 : 536.75 : 546.546.131 1341

Specific heats at low temperatures of hydrates of magnesium chloride. KELLEY, K. K., AND MOORE, G. E. *J. Amer. Chem. Soc.*, 65, *pp.* 2340–2342, *Dec.*, 1943.—[See Abstr. 2567 (1943)]. Specific-heat measurements are reported of the mono-, di-, tetra- and hexahydrates of $MgCl_2$ in the range 52° to 298°K. An anomaly was found in the sp. ht. of the hexahydrate with a peak temp. of 136·7°K. The entropies at 298·16°K. were computed to be, respectively, $32{\cdot}8 \pm 0{\cdot}5$, $43{\cdot}0 \pm 0{\cdot}5$, $63{\cdot}1 \pm 0{\cdot}7$ and $87{\cdot}5 \pm 1{\cdot}0$ cal./deg. mole. Free energies of formation of the hydrates from the elements and from anhydrous $MgCl_2$ and liquid water are listed.

536.631 : 548.0 : 535.338.42 *see Abstr.* 1317

536.658 : 531.72 *see Abstr.* 1272

536.7 : 512.94 : 548.0 *see Abstr.* 1451

536.7 : 532.73-1 *see Abstr.* 1282

536.7 : 669.25 : 548.73 *see Abstr.* 1458

536.75 : 546.546.131 : 536.63 *see Abstr.* 1341

537.12 : 530.145.63 = 4 1342

Model of point electron. II. STUECKELBERG, E. C. G. *Helv. Phys. Acta*, 17, 1, *pp.* 3–26, 1944.—A more general model of the point electron than that formerly proposed [Abstr. 1352 (1941)] is discussed. The electron interacts only with the Maxwell field. There is an infinite number of possible models, and the results which, on the theory of the extended electron, depend on the structure of the particle can only be arrived at on the new model if a certain invariant function of the model is given. The theory can be quantized, but a Schrödinger equation does not exist. A unitary Heisenberg matrix characterizes each quantized model. A. J. M.

537.214 : 541.182.025 1343

Electrical energy of two cylindrical charged particles. DUBE, G. P. *Indian J. Phys.*, 17, *pp.* 189–192, *Aug.*, 1943.—Using the approx. Debye–Hückel theory, an expression for the electrical energy of 2 cylindrical charged particles was worked out. This energy exhibits a min. for a certain value of the inter-particle distance and may be of importance in explaining thixotropic properties.

537.221 1344

A special charging rod for demonstrations in electrostatics. AINSLIE, D. S. *Amer. J. Phys.*, 12, *pp.* 43–44, *Feb.*, 1944.

537.226.1 : 537.562 1345

The dielectric constant of ionized air in a discharge tube in the range of wavelengths: 80 cm.–1 500 cm. ALAM, N., AND KHASTGIR, S. R. *Indian J. Phys.*, 17, *pp.* 204–215, *Aug.*, 1943.—Accurate determinations. The appearance of 3 distinct min. in the value of the permittivity of ionized air, in 3 different wavelength regions, is described. Employing the same discharge tube and passing the same current through it as during measurements, feeble oscillations of 3 different wavelengths occur, corresp. with the wavelengths where the min. were obtained. The anomalous values of the permittivity is attributed to anomalous dispersion in an absorbing medium containing electrons having different natural frequencies.

537.226.2 : 541.124.7 : 541.634 *see Abstr.* 1438

537.311.3 : 612.79 : 614.825 1346

The human skin as a conductor of 60-cycle alternating current of high intensity, studied on "electroshock" patients. LÖWENBACH, H., AND MORGAN, J. E. *J. Lab. Clin. Med.*, 28, *pp.* 1195–1198, *July*, 1943.—Reactions of the living human skin as a conductor of 60 c./s. a.c. up to 1 000 mA were studied on 31 individuals in 98 experiments. When 50–120 V is applied for 0·1–0·4 sec., the impedance drops immediately to a value betw. 270 and 120 Ω regardless of the original impedance, provided this is kept at or below 2 000 Ω; there is no further change of the impedance during the time of current flow. When the current is broken, the impedance—to 20 mV—rises suddenly by 80–150 Ω, according to the "shock" tension applied; it then increases over a period of many seconds, approaching the original value asymptotically. The skin of human corpses reacts similarly to that of living individuals, but the impedance drop is less the longer the interval between the time of death and of examination. C. J. G.

537.36 : 612.17 1347

A new hypothesis of the production of the *T* wave in the electrocardiogram based on electrokinetic phenomena. MILLER, J. R., AND DENT, R. F. *J. Lab. Clin. Med.*, 28, *pp.* 168–173, *Nov.*, 1942.—The nature of the *T* wave in the electrocardiogram suggests that it is due to an electrokinetic cause and does not represent retreat electrical disturbances. Observations here recorded suggest that the contraction of the heart with its resultant streaming potentials is responsible for the *T* wave. C. J. G.

537.363 : 541.132.3 1348

The iso-electric point of asclepain. CARPENTER, D. C., AND LOVELACE, F. E. *J. Amer. Chem. Soc.*, 65, *pp.* 2364–2365, *Dec.*, 1943.—The electrophoretic velocity of asclepain was measured in citrate, acetate, and phosphate buffer solutions in the *p*H range 1·8 to 8·0 and the electrical charge on the particle calculated. The iso-electric point of asclepain is at *p*H 3·11 or C_H $7·8 \times 10^{-4}$.

537.521 1349

On the currents carried by electrons of uniform initial velocity. JAFFÉ, G. *Phys. Rev.*, 65, *pp.* 91–98, *Feb.* 1 *and* 15, 1944.—Electrons enter the space between 2 infinite parallel planes with uniform velocity at rt. angles to the planes. The current is studied for all possible values (+ and −) of the p.d. between the planes. The complete solution can be obtained if this boundary condition for the current is accepted: The number of electrons entering the discharge space must be $\leqslant$ a given number N_0/cm.^{2}/sec., and is for each potential as high as the potential permits. The problem depends on two dimensionless parameters, a reduced plate distance ξ_0 (involving the current) and $\eta_0 = V_0/E_0$, where V_0 is the impressed p.d. and eE_0 the energy of the electrons.

537.521 : 621.315.618.9 1350

The electrical strength of gases. BONCH-BRUEVICH, A. M., GLIKINA, M. B., AND HOCHBERG, B. M. *J. Phys., USSR*, 3, 4–5, *pp.* 327–332, 1940.—[Abstr. 1130 B (1944)].

537.523 : 621.3.015.5 = 3 1351

Disruptive voltages in H_2, O_2, N_2, NO, HCl, HBr and HI. KOWALENKO, G. M. *J. Phys., USSR*, 3, 6, *pp.* 455 *et seq.*, 1940.—[Abstr. 1109 B (1944)].

537.523 : 621.3.015.5 = 82 1352

An investigation of the electrical strength of gases. HOCHBERG, B. M., AND SANDBERG. *J. Techn. Phys., USSR*, 12, 2–3, *pp.* 65–75, 1942. *English Abstr. in Wireless Engr*, 21, *p.* 144, *March*, 1944.—[Abstr. 1110 B (1944)].

537.523.3 : 547.3 : 541.64 1353

Acetylene polymer produced in electric discharge. GLOCKLER, G., AND HOLLINGSWORTH, C. A. *Trans. Electrochem. Soc.*, 84, *Prepr. No.* 16, 1943.—The solid polymerization product of acetylene and ethylene in silent and semi-corona discharge was obtained in various mixtures of these two gases. Various properties of the acetylene polymer were studied: light transmission, oxygen absorption, solubility and effect of temperature and pressure. E. R. A.

537.523.3 : 697.94 1354

The electric characteristics of the ozonator discharge. MANLEY, T. C. *Trans. Electrochem. Soc.*, 84, *Prepr. No.* 14, 1943.—The path of the discharge through the gas is terminated at one or both ends by an insulating layer such as glass, and a.c. must be used. The paper is an oscillographic study of the ozonator discharge, together with power measurements. E. R. A.

537.523.5 : 535.33.03 *see Abstr.* 1303

537.525.92 = 82 1355

Theory of non-stationary states of the electric discharge plasma. GRANOVSKY, B. *J. Phys., USSR.*, 3, 3, *p.* 195, 1940.—An essay on the theory of l.f. and m.f. processes in the plasma of a l.p. discharge; it is a natural generalization of Schottky's diffusion theory on the non-stationary states of the plasma. E. R. A.

537.527 : 621.3.015.5 = 3 1356

H.f. disruption of compressed gases. GÄNGER, B. *Arch. Elektrotechn.*, 37, *pp.* 267–286, *June*, 1943.—[Abstr. 1111 B (1944)].

537.531 : 535.33 1357

On the term values of X-ray spectra. HU TSI-MING. *Phys. Rev.*, 65, *pp.* 76–79, *Feb.* 1–15, 1944.—The term values of the *K*, *L*, and *M* levels of X-ray spectra can be given by the empirical formula

$$\nu(n,j) = \frac{1}{n^2}[Z - \sigma_0 - \phi(Z)]^2 + \frac{1}{n^4}\alpha^2(Z-\sigma_2)^4\left(\frac{n}{j+1/2} - \frac{3}{4}\right) + \ldots - 2\Sigma_i Z_i \frac{Z - S_i}{n_i^2}$$

where σ_0 and σ_2 are constants for a given level and $\phi(Z) = -0·098 - 1·80 \times 10^{-3}Z + 1·40 \times 10^{-4}Z^2$ for the *K* and *L* levels and = 0 for the *M* level. The values of the screening constants best suited to the above formula are given.

537.531 : 535.33 1358

The *K*-absorption spectra of Al and Mg. SANDSTRÖM, A. E. *Ark. Mat. Astr. Fys.*, 28*A*, 3, *No.* 12, [17 *pp.*], 1942.—Spectrograms showing the fine structure of the *K*-absorption edges in Al and Mg are examined and compared with previous work [Abstr. 3173 (1940)]. The ranges of min. absorption in Al correspond to definite Brillouin zones or groups of zones. All the known fringes except 2 can be identified with atomic planes against which the electron reflection takes place. The energy of the *K*-edge relative to the zero level is calculated from the spectroscopic data as 16·3 eV, as against 13–15 eV from thermionic data. The difference is attributed to displacement of the edge by the fringe corresponding to the (220) zone. Some of the fringes observed in Mg (hexagonal) are identified by comparison with the results for Al (face-centred cube). A. HU.

537.531 : 535.338.1 1359

An experimental investigation into *L*-emission spectra. HAGLUND, P. *Ark. Mat. Astr. Fys.*, 28*A*, 2, *No.* 8, [70 *pp.*], 1942.—Measurements in the *L* series of the elements 53 I to 37 Rb are made using a vacuum-tube spectrograph for the stronger lines and a bent-crystal spectrograph for the weaker. The apparatus and experimental methods employed are described in detail. The $L\alpha$ doublet and the $\beta_3\beta_4$ doublet are resolved throughout, and the quadrupole lines $\beta_{10}\beta_9$ are found for the elements 53 I to 46 Pd. With the L_{III} edge as a base, the relative energy levels are calculated for the elements investigated. Chemical combination is shown to displace γ_1 and β_2 from 46 Pd downwards, and to split the lines in certain of the higher oxides. The possibility of using fluorescent radiation in the study of this effect is discussed. A. HU.

537.531 : 535.341 1360

Measurements on Roentgen-ray production and absorption in the range 0·7 to 2·5 megavolts. ATTA, L. C. VAN, PETRAUSKAS, A. A., AND MYERS, F. E. *Amer. J. Roentgenol. and Radium Ther.*, 50, *pp.* 803–818, *Dec.*, 1943.—The intensity and the total mass absorption coeff. of the heterogeneous radiation pro-

duced in a thick Au target were measured as a function of tube voltage (0·7–2·5 MV), angle with resp. to electron beam, and thickness and material of the filter. Curves giving the dependence of absorption coeff. on voltage are presented for Pb, Sn, Cu, Al, and H_2O. A method for calculating efficiency of X-ray production from these data is described and used to obtain results in agreement with theory from 0·90 to 2·35 MV.

537.533.72 : 539.163.2 1361

Investigations on the use of magnetic lenses for β-spectroscopy. SIEGBAHN, K. *Ark. Mat. Astr. Fys.*, 28*A*, 4, *No.* 17, [27 *pp.*], 1942.—Details are given of a high-dispersion high-intensity β-spectrograph employing the focusing effect of a homogeneous longitudinal magnetic field. Registration is by a Geiger counter. A. HU.

537.533.72 : 621.385.833 1362

The transmission type of electron microscope and its optics. MARTON, L., AND HUTTER, R. G. E. *Proc. Inst. Radio Engrs, N.Y.*, 32, *pp.* 3–12, *Jan.*, 1944.—[Abstr. 1207 B (1944)].

537.533.73 : 541.6 *see Abstr.* 1435

537.533.8 : 539.163.2 = 3 1363

Emission of light positive particles by β-radiators. BRADT, H., HEINE, H. G., AND SCHERRER, P. *Helv. Phys. Acta*, 16, 5, *pp.* 491–502, 1943.—Wilson-chamber experiments confirm the existence of traces due to light positive particles in the radiation from UX_2 and Th(C + C′), similar to those formerly observed [Abstr. 1720 (1934)]. The production of pairs by electron and positron emission from β-radiators is investigated. The effective cross-section for pair production by electrons is not "anomalously" great. The β-radiators UX_2 and RaE, and radiophosphorus P^{32}, show no emission of positrons with a frequency of the order 10^{-3} to 10^{-2} $e+$ per disintegration. It is not yet possible to put forward a satisfactory explanation of the positive traces. A. J. M.

537.533.8 : 539.163.2 = 3 1364

Pair production by electron and positron emission from β-radiators. BRADT, H. *Helv. Phys. Acta*, 17, 1, *pp.* 59–94, 1944.—The results of Wilson-chamber experiments have been explained by pair creation from electrons. The effective cross-section for pair production from electrons of energy amounting to some mc^2 in Pb should be about 10^{-22} cm.², i.e. β-radiators should produce 10^{-3} to 10^{-2} positrons per disintegration in consequence of materialization of the kinetic energy of the breakdown electrons. To test this, the γ-radiation from a UX source covered with Pb or Al was investigated with coincidence counters. (γ, γ) coincidences were determined in two different geometrical arrangements. No effect caused by annihilation radiation could be observed. This shows that, for UX_2, less than 1×10^{-4} positrons are emitted per disintegration, and the effective cross-section for pair production by rapid UX_2 electrons in Pb is less than 8×10^{-25} cm.² Results for the γ-radiation of P^{32} and RaE are discussed, and similar conclusions are drawn as for UX_2. A. J. M.

537.534.8 : 539.172.1 1365

The angular distribution of alphas from $Li^7(p, \alpha)\alpha$. SWARTZ, C. D., ROSSI, H. H., JENNINGS, B., AND INGLIS, D. R. *Phys. Rev.*, 65, *pp.* 80–83, *Feb.* 1 *and* 15, 1944.—The tracks formed in photographic emulsions by alphas from the reaction $Li^7(p, \alpha)\alpha$ at various angles from the beam were observed at bombarding energies E between 400 and 900 ekV. The angular distribution proportional to $1 + A(E) \cos^2 \theta$, as found by Young, Ellett and Plain at lower voltages, was also observed, and a max. of $A(E)$ was found at 675 ekV.

537.534.8 : 539.172.1 1366

The angular distribution of alphas from $F^{19}(p, \alpha)O^{16}$. ROSSI, H. H., AND SWARTZ, C. D. *Phys. Rev.*, 65, *pp.* 83–85, *Feb.* 1 *and* 15, 1944.—The angular distribution of alphas from the reaction $F^{19}(p, \alpha)O^{16}$ has been investigated at bombarding voltages between 500 and 900 ekV. The distribution depends on bombarding energy, contrary to the result found by McLean, Ellett and Jacobs at lower voltages.

537.534.8 : 539.172.1 1367

Interpretation of the angular distribution of alphas from $Li^7(p; \alpha)\alpha$. EISNER, E. *Phys. Rev.*, 65, *pp.* 85–87, *Feb.* 1 *and* 15, 1944.—Proton penetration factors for $Li^7(p; \alpha)\alpha$ are calculated under several assumptions of nuclear potential. The status of the Critchfield–Teller theory is briefly discussed in the light of these calculations and the angular distribution found by Jennings, Swartz and Rossi.

537.562 : 537.226.1 *see Abstr.* 1345

537.591.8 : 539.172 1368

Cascade showers and nuclear disintegrations at 10 000 feet. HAZEN, W. E. *Phys. Rev.*, 65, *pp.* 67–75, *Feb.* 1 *and* 15, 1944.—A large cloud chamber containing 8 Pb plates was operated without counter control at 10 000 ft. In 8 500 photographs, 1 090 cascade showers and 58 nuclear disintegrations were observed. The differential energy spectrum for the shower-producing rays, obtained from the rel. frequency of occurrence for showers of a given size, is $\propto E^{-1\cdot7}$ for $E = 2 \times 10^8$ eV and to $E^{-3\cdot0}$ for $E = 10^9$ eV. The shower-producing rays with $E > 2 \times 10^8$ eV constituted 6·5% of the radiation observed in the cloud chamber; 1/3 of the shower-producing rays were photons. Approx. 1/3 of the observed disintegrations contained particles that penetrated at least 0·7 cm. of Pb and 4 contained particles that penetrated at least 2·8 cm. of Pb. Most of the disintegration particles were protons or mesotrons. The initiating particles were neutrons and protons, with the former predominant for the lower energy disintegrations. There is no sharp distinction betw. low-energy and high-energy disintegrations. No correlation was observed betw. the disintegrations and the cascade showers.

538.112 : 530.145 = 3 1369

Theory of magnetically charged particles. FIERZ, M. *Helv. Phys. Acta*, 17, 1, *pp.* 27–34, 1944.—A new proof of the theorem proposed by Dirac [Abstr. 340 (1932)], that if magnetically charged particles are introduced into the quantum theory, their magnetic charge must be an integral multiple of a unit charge $hc/2e$, where e is the elementary electric charge, is given. A. J. M.

538.214 : 541.132 *see Abstr.* 1420

538.214 : 546.717 1370

Magnetic studies on permanganates. MOOKHERJEE, A. *Proc. Indian Ass. Cult. Sci.*, 26, *pp.* 8–9, *Aug.*, 1943.

538.214 : 546.725 1371

Magnetic susceptibility of iron tetracarbonyl. CUTFORTH, H. G., AND SELWOOD, P. W. *J. Amer. Chem. Soc.*, 65, *pp.* 2414–2415, *Dec.*, 1944.—The magnetic susceptibility of iron tetracarbonyl at room temperature, corrected for ferromagnetic impurity, is $-0{\cdot}07 \times 10^{-6}$. The carbonyl appears to undergo a slow change, with an increase in susceptibility, when it stands in the dark [see Abstr. 1565 (1942)].

538.24 : 518.41 : 621.318.2 1372

The geometry of demagnetizing curves, and its consequences for permanent-magnet materials. HOSELITZ, K. *Phil. Mag.*, 35, *pp.* 91–102, *Feb.*, 1944.—A demagnetizing curve is the descending part of the hysteresis loop which lies between the points P ($B = B_r$, $H = 0$) and Q ($B = 0$, $H = H_c$). The three most important features are $(BH)_{max}$, B_r and H_c. Let M be the fourth vertex of the rectangle defined by O, P and Q. The $(BH)_{max}$ point is assumed to lie on the diagonal OM. Two lim. demagnetizing curves are found whose $(BH)_{max}$ points M_1 and M_2 are given respectively, as follows: M_1 is the intersection with OM of the line of slope unity through P, and M_2 is the intersection of OM and PQ. The $(BH)_{max}$ values are, respectively, $\alpha = B_r H_c/4$ and $\beta = B_r^2 H_c/(B_r + H_c)^2$. In practice the demagnetizing curve of a material will lie between the two lim. curves. For this reason two intermediate curves are defined which have $(BH)_{max}$ values of $\sqrt{\alpha\beta}$ and $(\alpha + \beta)/2$ respectively. It is shown, by examples, that these values are close to those of ordinary magnet alloys. The paper concludes with a discussion of the significance of the above demagnetizing curves in the development of alloys having high $(BH)_{max}$ values. L. S. G.

538.56 : 621.396.671 1373

The electrical oscillations of a prolate spheroid. II. Prolate spheroidal wave functions. PAGE, L. *Phys. Rev.*, 65, *pp.* 98–110, *Feb.* 1 *and* 15, 1944.—The vector wave equation in prolate spheroidal co-ordinates ξ, η, ϕ is set up, the variables are separated, and the characteristic values and functions of the resulting ordinary differential equations are obtained in series which converge rapidly in the neighbourhood of resonance for spheroids of eccentricity $\simeq 1$. The coefficients of the 2 independent primitives in the linear combinations representing diverging and converging waves at infinity are calculated. The zeros of certain of the characteristic values are investigated. [See Abstr. 3034 (1938)].

538.56 : 621.396.671 1374

The electrical oscillations of a prolate spheroid. III. The antenna problem. PAGE, L. *Phys. Rev.*, 65, *pp.* 111–117, *Feb.* 1 *and* 15, 1944.—The straight-wire aerial is approximated by a perfectly conducting prolate spheroid of eccentricity $\simeq 1$. The first 3 harmonics of the axially symmetrical free oscillations are discussed, with calculation of the wavelength and the log. decrement. The tangential electric field component of a plane wave with E parallel to the axis of the spheroid is expanded in prolate spheroidal wave functions. The oscillations forced by such a plane wave are discussed for frequencies in the neighbourhood of resonance with ref. to current distribution, radiation resistance and scattered field.

538.566.2 : 621.396.11 1375

Theory of the coastal refraction of electromagnetic waves. GRÜNBERG, G. A. *J. Phys., USSR*, 6, 5, *pp.* 185–209, 1942.—[See Abstr. 1980 (1943)]. The boundary conditions for propagation over a discontinuity of ground are derived, and are used to formulate an integral equation for the vertical electrical field, which is the basis of the problem. The special case of an infinite straight coastline is analysed in detail, and an approx. solution is obtained for the field at ground level. It is shown that, after a deviation at the coast, the direction of propagation returns asymptotically towards that of the primary wave. Some general arguments concerning the approx. solution in the case of irregular small islands are given, and new formulae for solving the integrals involved, using Bessel's functions, are derived. No numerical or practical results are given. F. T. F.

538.74 : 629.135 : 621.316.97 1376

Electric circuits and the magnetic compass. BURT, R. C., AND BECK, H. R. *Trans. Amer. Inst. Elect. Engrs*, 63, *pp.* 24–26, *Jan.*, 1944.—[Abstr. 1139 B (1944)].

539.132 : 535.338.42 1377

A note on the oscillating rotator. BASU, K. *Indian J. Phys.*, 17, *pp.* 193–196, *Aug.*, 1943.—The problem of the oscillating rotator [Abstr. 2902 (1938)] is solved from the standpoint of Sonine's polynomials [Abstr. 2652 (1943)].

539.132 : 678 1378

The statistical length of rubber molecules. TRELOAR, L. R. G. *Trans. Faraday Soc.*, 40, *pp.* 109–116, *March–April*, 1944.—The paper applies the methods worked out [Abstr. 2846 (1943)] to the problem of the rubber molecule. Distribution functions covering lengths up to 98% of the fully extended length are given for chains corresponding to mol. wt. up to 17 400.

539.15 : 539.2 : 519.34 1379

Some applications of the Rayleigh–Ritz method to the theory of the structure of matter. JAMES, H. M. *Bull. Amer. Math. Soc.*, 47, *pp.* 869–884, *Dec.*, 1941.—A critical discussion of the potentialities and limitations of the Rayleigh–Ritz method. Applications are made to the H and He atoms, the lower excited states of He, the H molecule and the Li atom. It does not seem useful, however, to apply the Ritz method in accurate treatment of atoms more complicated than Li. Previous results obtained by the author are discussed [see Abstr. 4939 (1938) and 2897 (1939)]. L. S. G.

539.152.1 = 3 1380

Vector meson theory. WENTZEL, G. *Helv. Phys. Acta*, 16, 6, *pp.* 551–596, 1943.—The symmetrical vector theory with the general two-parameter coupling method is investigated for the case of strong coupling. The calculations differ according as the ratio f/g of the two parameters is below or above a certain critical value. In the former case the results are the same as for $f = 0$ (no coupling of longitudinal mesons). In both cases the isobar energy, the meson scattering

cross-section, and the statical nuclear forces for large distances, are calculated. A. J. M.

539.152.1 = 3 1381

Stability of heavy nuclei in the meson theory. COESTER, F. *Helv. Phys. Acta*, 17, 1, *pp.* 35–58, 1944.—It is shown, by means of the Thomas–Fermi approximation, that for all coupling arrangements which give rise to a positive interaction potential, the saturation character of the nuclear force is unchanged. Considerations of stability provide definite limiting criteria for the choice of coupling parameters, and the isobar excitation energy. The nuclear charge can be calculated taking into account the Coulomb energy, and the results agree with experiment. A. J. M.

539.152.1 = 4 1382

Nuclear forces in the theory of pairs. HOURIET, A. *Helv. Phys. Acta*, 16, 6, *pp.* 528–550, 1943.—The results already obtained on strong coupling [Abstr. 2894 (1942)] are completed, and the potential energy of a network of nucleons is calculated. The calculations show that the hypothesis of strong coupling leads to saturated forces of attraction. A. J. M.

539.153.4 = 4 1383

Values of the energy of the electronic configuration $3d^24p$. ANTUNES, M. T. *Portugaliae Physica*, 1, 1, *pp.* 1–13, 1943.—The matrix of electrostatic interactions and orbital spin of the d^2p state is calculated. Calculated and empirical values of the energy of the $3d^24p$ state of Ti II are given. A. J. M.

539.163.2 : 537.533.72 *see Abstr.* 1361

539.163.2 = 4 1384

Analysis of β-ray spectra. GIBERT, A. *Portugaliae Physica*, 1, 1, *pp.* 15–28, 1943.—Experimental facts which are not readily explained by supposing that the sole cause of β-spectra is an internal photoelectric effect are reviewed. The work of Stahel on coupling between the nucleus and extranuclear electrons in β-ray transformations is analysed and discussed, and it is shown that his results are in agreement with more recent determinations. A. J. M.

539.163.2 = 4 1385

Einstein's photo-electric law and the phenomenon of internal conversion. VALADARES, M. *Portugaliae Physica*, 1, 1, *pp.* 35–41, 1943.—Comparison of results for the wavelength of γ-rays by magnetic spectrography of β-rays due to internal conversion, and by crystalline diffraction of γ-rays, shows close agreement between the two methods, and indicates that Einstein's photo-electric law is valid for the phenomenon of internal conversion of γ-rays. A. J. M.

539.163.2 : 537.533.8 = 3 *see Abstr.* 1363, 1364

539.163.2 : 546.792 = 3 1386

Conversion lines in the β-spectrum of UX. BRADT, H., HEINE, H. G., AND SCHERRER, P. *Helv. Phys. Acta*, 16, 5, *pp.* 455–470, 1943.—The β-spectrum of UX_2 has been investigated in the energy range 650–850 ekV, using a magnetic spectrograph with coincidence counters. Many close lines of the spectrum were resolved and their intensities determined. For the K and L_1 conversion lines the mean conversion probabilities are 0·36 and 0·10, respectively. A. J. M.

539.172 : 537.591.8 *see Abstr.* 1368

539.172.1 : 537.534.8 *see Abstr.* 1365, 1366, 1367

539.2 : 519.34 : 539.15 *see Abstr.* 1379

539.219.1 : 533.15 1387

Occlusion of hydrocarbons by chabazite and analcite. BARRER, R. M., AND IBBITSON, D. A. *Trans. Faraday Soc.*, 40, *pp.* 195–206, *May*, 1944. [See Abstr. 3973 (1938)]. When the minerals were suitably outgassed, they occluded *n*-hydrocarbons copiously, but all branched-chain hydrocarbons were totally excluded. *n*-hydrocarbons of greater mol. wt. were occluded rapidly only betw. 100°–300°C. Isotherms and isosteres were determined for some normal hydrocarbons, and in both minerals it was shown that the affinity of solutes for the lattice increased in the order $He < H_2 < O_2$ or $A < N_2$ or $CH_4 < C_2H_6 < C_3H_8 < n\text{-}C_4H_{10}$. Thermodynamic properties of the zeolitic solid solutions were obtained (ΔH, ΔA_0, ΔS_0) as functions of charge of gas in the crystal, chain-length, or temperature.

539.219.1 : 541.127 : 533.15 *see Abstr.* 1286

539.262 : 621.386.1 1388

An automatic X-ray diffraction apparatus. DAVEY, W. P., SMITH, F. R., AND HARDING, S. W. *Rev. Sci. Instrum.*, 15, *pp.* 37–45, *Feb.*, 1944.—[Abstr. 1208 B (1944)].

539.264 : 679.5 1389

Molecular orientation in moulded plastics. BAKER, W. O. *Bell. Lab. Rec.*, 22, *pp.* 119–122, *Nov.*, 1943.—A short note, illustrated by X-ray diffraction patterns, on the effect of moulding conditions on the arrangements of the molecules within the moulding material. E. R. A.

539.319 : 620.179 : 621.386.1 1390

The measurement of residual stresses in metals by the X-ray back-reflection method, with special reference to industrial components in aluminium alloys. FROMMER, L., AND LLOYD, E. H. *J. Inst. Met.*, 70, *pp.* 91–124, *March*, 1944.—[Abstr. 1209 B (1944)].

539.377 : 621.315.616.9 1391

Deformation under load of rigid plastics. BURNS, R. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 87, 1943.—[Abstr. 1128 B (1944)].

539.378.3 : 532.739.2 *see Abstr.* 1283

539.382/.383 : 620.172/.173 1392

Axial rigidity of perforated structural members. GREENSPAN, M. *J. Res. Nat. Bur. Stand., Wash.*, 31, *pp.* 305–322, *Dec.*, 1943.—Formulae are derived for computing the over-all lengthening (or shortening) of a tension (or compression) member having a uniform gross cross-section and a series of similar perforations of circular, elliptical, or ovaloid shape uniformly distributed along the length. Tests on strips having circular perforations show that the formula gives good results.

539.388.23 : 621.181 1393

Theory of the expanding of boiler and condenser tube joints through rolling. NADAI, A. *Trans. Amer. Soc. Mech. Engrs.*, 65, *pp.* 865–880, *Nov.*, 1943.—Boiler and condenser tubes are fitted into holes in adjoining drums or head plates by expanding the tube ends by small revolving rolls whose pressure creates a radial plastic distribution of stress in the tube wall and around the hole in the adjoining heavy steel plate. After the tube has been rolled, a system of residual stresses remains in the material near the joint which

is essential for maintaining pressure tightness. These plastic states of stress have been investigated for various types of stress/strain characteristics of the tube metal and steel of the head plates, and rules are given for computing the stresses in moderately thick-walled tube under external and internal pressure, either in the elastic or plastic state of stress. The curve representing residual pressure shows a decline in slope after a small increase in tube dia., indicating that, after a relatively small amount of expansion, further rolling does not produce a proportional increase of residual pressure. A. C. W.

539.389.3 : 678 1394

Relaxation of rubber-like materials. HOPKINS, I. L. *Proc. Amer. Soc. Test. Mater., Prepr. No. 87a*, 1943.—A method is described for measuring relaxation wherein each specimen is permanently fixed in its own test cell which may be subjected to any desired atmospheric conditions. E. R. A.

539.4 : 621.315.51 1395

Physical metallurgy of copper and copper-base alloys. BRACE, P. H. *Elect. Engng, N.Y.*, 63, *pp.* 11–17, *Jan.*, 1944.—[Abstr. 1123 B (1944)].

539.4.016 : 548.73 *see Abstr.* 1459

539.4.016 : 669.14 1396

Creep strength, stability of microstructure and oxidation-resistance of chromium-molybdenum and 18 chromium-8 nickel steels. MILLER, R. F., BENZ, W. G., AND DAY, M. J. *Amer. Soc. Met., Prepr. No.* 37, [20 *pp.*], *Oct.*, 1943.—The paper is one of a series of reports from the laboratories of the U.S. Steel Corporation on the effect of heat-treatment and other variables on the high-temp. properties of steels. E. R. A.

539.431 : 669.245 : 620.178.3 1397

The fatigue properties of some cold-drawn nickel-alloy wires. KENYON, J. N. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 14, 1943.—[Abstr. 1089 B (1944)].

539.431 : 669.35 : 620.178.3 1398

Fatigue tests on some copper alloys in wire form. BURGHOFF, H. L., AND BLANK, A. I. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 45, 1943.—[Abstr. 1090 B (1944)].

539.431 : 678 1399

Fatigue characteristics of rubber. YOST, F. L. *Trans. Amer. Soc. Mech. Engrs*, 65, *pp.* 881–888, *Nov.*, 1943.—A study of dynamic and static fatigue in rubber and synthetic samples (failure under repeated oscillation or under a static load). The specimens and fatigue are illustrated, and data from quantitative studies cover both types of fatigue. The paper summarizes the results of previous work. In the discussion it is pointed out that the author has established that the dynamic fatigue life of rubber has a min. value at zero min. linear strain. G. E. A.

539.434 : 620.172.251.2 1400

Interpretation of creep-test data. MCVETTY, P. G. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 41, 1943.—[Abstr. 1087 B (1944)].

539.434 : 620.172.251.2 1401

Hyperbolic-sine chart for estimating working stresses of alloys at elevated temperatures. NADAI, A., AND MCVETTY, P. G. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 42, 1943.—[Abstr. 1088 B (1944)].

539.434 : 620.172.251.2 : 669.14 1402

Structure and creep characteristics of cast carbon-molybdenum steel at 950°F. MONTGOMERY, H. E., AND URBAN, J. *Bull. Amer. Soc. Test. Mater., Prepr. No.* 28, 1943.—[Abstr. 1070 B (1944)].

539.434 : 666.97 1403

A new aspect of creep in concrete and its application to design. MCHENRY, D. *Proc. Amer. Soc. Test. Mater., Prepr. No.* 64, 1943.—The nature of creep and recovery are discussed, and a principle is stated which governs the superposition of creep when the load varies with time. An equation is developed which defines creep as a function of stress, age at loading and elapsed time after loading. This creep equation, combined with the superposition principle, provides a means for expressing the strain history when the stress history is known. E. R. A.

539.501 : 679.5 1404

Plastics: structure and physical properties. TUCKETT, R. F. *Chem. and Ind.*, 62, *pp.* 430–432, 1943. *Abstr. in J. Text. Inst.*, 35, *A25*, *Jan.*, 1944.—Any general deformation of a plastic is shown to comprise the sum of (*a*) a deformation due to the stretching of the individual links or change in the angle between adjacent links in the molecular chain, (*b*) a deformation due to change in chain orientation, and (*c*) a deformation due to whole portions of chains sliding over each other.

539.501 : 691.16 1405

Mineral powder suspensions in bitumen and related materials. I. WALTHER, H. *Kolloid Z.*, 103, 1, *pp.* 54–60, 1943.—A review of conclusions reached by practice and research on the stabilizing effect of mineral powders on bituminous materials is summarized as follows: suitable mineral powders stabilize bitumen and related materials by raising the softening point and lowering the breaking point and also by increasing the resistance to flow at high temperatures and reducing brittleness at low temperatures. They increase the weather resistance of bitumen films, and where the particles are of suitable shape, they increase the stability of the film by reducing the tendency to cracking. E. R. A.

539.52 : 621.791.753 : 621.367 1406

Ductile weld metal. GAYLEY, C. T., AND WILLIS, J. G. *Weld. J.*, *pp.* 8*s*–11*s*, *Jan.*, 1944.—[Abstr. 1191 B (1944)].

539.622 : 621.771 1407

The calculation of roll pressure in hot and cold flat rolling. OROWAN, E. *Proc. Instn Mech. Engrs, Lond.*, 150, 4, *pp.* 140–167, 1943.—[Abstr. 1270 B (1944)].

541.123.21 1408

The system Li_2SO_4–H_2O. CAMPBELL, A. N. *J. Amer. Chem. Soc.*, 65, *pp.* 2268–2271, *Dec.*, 1943.—The following data have been elucidated: (*a*) The transition point of the change: $Li_2SO_4 . H_2O \rightleftarrows Li_2SO_4 + H_2O$, which lies at 232·8° and a pressure of 26·7 atm. Three independent methods were used, the dilatometric, the method of v.p. and the thermometric. (*b*) The solubility between 110° and 214°. (*c*) The ice-line. The existence of a higher hydrate, possibly $Li_2SO_4 . 2H_2O$, is considered doubtful. The technique involved was (*a*) dilatometric, and (*b*) a study

of the equilibrium diagram of the system Li_2SO_4–LiCl–H_2O, at −12·25°.

541.123.31 1409

Equilibrium measurements by infra-red absorption for the formation of nitric acid from oxygen, water vapour and nitrogen dioxide. JONES, E. J. *J. Amer. Chem. Soc.*, 65, *pp.* 2274–2276, *Dec.*, 1943.—A direct determination was made of the equilibrium const. for the reaction $H_2O(g) + NO_2(g) + {}^1/_2O_2(g) \rightarrow 2HNO_3(g)$, using the infra-red absorption at 1·4 μ of HNO_3 vapour as a method of analysis. Transmission values of HNO_3 and HNO_2 in the 1·4 μ region are given.

541.123.5 1410

The reciprocal salt pair $NaClO_3 + KCl \rightleftarrows NaCl + KClO_3$ in water at 0 and 40°. MUNTER, P. A., AND BROWN, R. L. *J. Amer. Chem. Soc.*, 65, *pp.* 2456–2457, *Dec.*, 1943.—The isothermally invariant points for the system of the reciprocal salt pair $NaClO_3 + KCl \rightleftarrows NaCl + KClO_3$ in water were determined at 0 and 40°. The stable salt pair in this system from 0 to 40° is $KClO_3$–NaCl. The isothermally invariant point of the system $NaClO_3$–$KClO_3$–H_2O at 0° was determined. The isothermally invariant point for the system $NaClO_3$–$KClO_3$–H_2O at 40° and that for the system $KClO_3$–KCl–H_2O at 0° were re-determined.

541.123.59 1411

Systems with boron trifluoride. III. BOOTH, H. S., AND WALKUP, J. H. *J. Amer. Chem. Soc.*, 65, *pp.* 2334–2339, *Dec.*, 1943.—Thermal analysis of BF_3 and chlorofluoromethanes and tetrafluoromethane showed limited miscibility, such that compound formation could not be established. While phosphoryl fluoride forms a compound with BF_3, the sulphur analogue PSF_3 gave no evidence of compound formation, nor did PF_3. Thionyl fluoride reacts with BF_3 to give a 1 : 1 compound melting at (− 140·8 ± 0·5)°.

541.124 1412

Consecutive competitive reactions. FUOSS, R. M. *J. Amer. Chem. Soc.*, 65, *pp.* 2406–2408, *Dec.*, 1943.—The following sequence of irreversible reactions is considered: $AX_4 + RY \rightarrow RAX_3 + XY$, $RAX_3 + RY \rightarrow R_2AX_2 + XY$, $R_2AX_2 + RY \rightarrow R_3AX + XY$, $R_3AX + RY \rightarrow R_4A + XY$, in which the reagent RY can replace the X's of AX_4 one at a time by R's. After the reaction has started, four species are competing for reagent, and in this paper are calculated the relative amounts of the five species AX_4 . . . R_4A as a function of the amount of reagent added.

N. M. B.

541.124 : 541.64 *see Abstr.* 1439

541.124.7 : 537.226.2 : 541.634 *see Abstr.* 1438

541.124.7 : 541.64 *see Abstr.* 1440

541.126 : 534.222.2 *see Abstr.* 1291

541.126 : 778.3 *see Abstr.* 1500

541.127 : 539.219.1 : 533.15 *see Abstr.* 1286

541.127 : 541.128.24 1413

The autoxidation of inorganic reducing agents. II. Stannous chloride (experimental). III. Stannous chloride (theoretical). LACHMAN, S. J., AND TOMPKINS, F. C. *Trans. Faraday Soc.*, 40, *pp.* 130–141, *March–April*, 1944.—A complete study has been made of the effect of various impurities on the rate of oxidation of aq. $SnCl_2$ solutions by oxygen, and of the experimental errors. Discrepancies found in earlier investigations are examined. The experimental curves for the variation of the rate of autoxidation of $SnCl_2$ with variation in total Cl′, H· and Sn·· ion conc. are analysed. Agreement is found by assuming the rate to be $\propto \sqrt{HSnCl_3}$ conc., but the oxidation of other species at a much slower rate is not excluded. [See Abstr. 929 (1943)].

541.127 : 772 1414

Ascorbic and iso-ascorbic acids as photographic developing agents. JAMES, T. H. *J. Amer. Chem. Soc.*, 66, *pp.* 91–94, *Jan.*, 1944.—The course of photographic development by *l*-ascorbic and *d*-iso-ascorbic acids is not affected by the oxidation products. The iso-ascorbic acid reacts at a greater rate than the ascorbic acid. At *p*H 10 or above, the active developer consists of the bivalent ion. This is adsorbed prior to reaction with the AgBr. In caustic solution, diffusion rates become important in determining the measured development rate. The rate of development is dependent upon the nature and conc. of the salts present. The rate increases with increasing salt conc.

541.127.3 1415

The pyrolysis of digermane. EMELÉUS, H. J., AND JELLINEK, H. H. G. *Trans. Faraday Soc.*, 40, *pp.* 93–99, *March–April*, 1944.—The thermal decomposition of digermane was studied at 195°–220°C. The reaction is, in its middle stages, of the first order and homogeneous, has an induction period, and is retarded in its later stages. The activation energy is 33·7 kg. cal. Digermane was also decomposed in the presence of propylene and hydrogen to elucidate the mechanism of the reaction more fully. The observed facts are discussed and a chain mechanism is proposed.

541.128.1 : 541.62 : 547.214 1416

The catalytic isomerization of paraffin hydrocarbons. I. Butanes. LEIGHTON, P. A., AND HELDMAN, J. D. *J. Amer. Chem. Soc.*, 65, *pp.* 2276–2280, *Dec.*, 1943.—The homogeneous liquid-phase isomerization of *n*-butane was studied. Al_2Br_6 and HBr mixtures were employed as catalyst. Completely anhydrous Al_2Br_6 has no action on *n*- or *i*-butane, but traces of moisture are sufficient to engender isomerization in the presence of the halide. From the rate studies it is concluded that $HAlBr_4$ is the true catalytic agent in this case. The apparent activation energy for the isomerization of *n*-butane is 9·2 kcal./mole. From the rate const. and activation energy, a temperature-independent rate factor of $10^{5\cdot4}$ is calculated.

541.128.1 : 541.64 1417

N-nitrosoacylarylamines as catalysts in addition polymerization. BLOMQUIST, A. T., JOHNSON, J. R., AND SYKES, H. J. *J. Amer. Chem. Soc.*, 65, *pp.* 2446–2448, *Dec.*, 1943.—N-nitrosoacylarylamines will effect the polymerization of styrene, methyl methacrylate and acrylonitrile. The number of catalyst fragments contained in the polymers varied. Although some polymers showed only one catalyst fragment attached per polymer molecule, others were formed which contained 2 or more such fragments. Only the active free aryl radicals produced in the decomposition of the N-nitrosoacylarylamines are incorporated in the polymer molecules. The free acid radicals do not appear to be involved in the polymer formation.

541.128.2 1418

Behaviour of metals in nitric acid. EVANS, U. R. *Trans. Faraday Soc.*, 40, *pp.* 120–130, *March–April*, 1944.—The principal facts can be explained without special assumptions other than that (1) those equations are most probable which involve fewest molecules, (2) oxides of type M_2O_3 are dissolved far less quickly than those of type MO. (1) leads to the view that the attack on relatively noble metals like Cu will be autocatalytic, an effect which is absent on metals like Zn. (2) explains the passivity of Fe in conc. HNO_3. The breakdown of passivity is connected with reduction to the rapidly dissolving divalent condition; it can be avoided by suitable anodic treatment which prevents the destructive transformation, e.g. by visible films of interference-colour thickness. The views given explain the fact that HNO_3, sufficiently dilute to act violently on Fe, has only a slow action on Al where divalent compounds are absent, or on Fe containing Cr, a metal forming only unstable divalent compounds. N. M. B.

541.128.24 : 541.127 *see Abstr.* 1413

541.128.3 1419

The reaction of sulphur dioxide with olefins: the ceiling temperature phenomenon. SNOW, R. D., AND FREY, F. E. *J. Amer. Chem. Soc.*, 65, *pp.* 2417–2418, *Dec.*, 1943.—Simple olefin hydrocarbons and SO_2 undergo a catalysed reaction in a homogeneous liquid phase to form polysulphones of high mol. wt. As reaction temperature is elevated, the reaction was found to be suddenly arrested at a characteristic level, but reaction sets in again upon lowering the temperature below this level.

541.132 : 538.214 1420

Complex ions. VI. The magnetic moments of some iron (III) complex ions. WERBEL, B., DIBELER, V. H., AND VOSBURGH, W. C. *J. Amer. Chem. Soc.*, 65, *pp.* 2329–2334, *Dec.*, 1943.—[See Abstr. 2847 (1943)]. Fe (III) ion in perchlorate solutions containing excess perchloric acid at a conc. $> 0{\cdot}1\ M$ has a magnetic moment = the theoretical spin moment of 5·92 Bohr magnetons. There is no change in moment when oxalate, 8-hydroxyquinoline-5-sulphonate, chloride thiocyanate and dichloracetate complexes are formed in solution from Fe (III) ion. A decrease in moment takes place when acetate, monochloracetate, hydrogen-phosphate, pyrophosphate, lactate, tartrate, citrate and aminoacetate complexes are formed. In these cases the apparent moment varies with the conc. of excess anion, or with the acidity, or both, indicating the presence of more than 1 compound.

541.132 : 541.452 *see Abstr.* 1432

541.132 : 541.8 1421

Complex ions. VII. A solubility method for the determination of instability constants in solution and the amines of nickel, cadmium and magnesium. DERR, P. F., AND VOSBURGH, W. C. *J. Amer. Chem. Soc.*, 65, *pp.* 2408–2411, *Dec.*, 1943.—Instability constants for the complex ions formed from Ni, Cd and Mg ions and NH_3 were determined by measurements of the solubility of $AgIO_2$ in NH_3 solutions containing the complex ions. Instability constants were determined for monammine, diammine and triammine Ni ions, and monammine Cd and Mg ions. The solubility of $BaIO_2$ in NH_3 solutions was determined.

541.132 : 541.8 1422

Complex ions. VIII. Pyridine–silver ions. VOSBURGH, W. C., AND COGSWELL, S. A. *J. Amer. Chem. Soc.*, 65, *pp.* 2412–2413, *Dec.*, 1943.—The solubilities of $AgIO_2$, Ag_2SO_4 and $AgBrO_2$ in dilute pyridine solutions were determined. The results are interpreted in terms of two complex ions, $AgPy^+$ and $AgPy^{2+}$, with dissociation constants K_1 and K_2 equal to $1{\cdot}0 \times 10^{-2}$ and $7{\cdot}8 \times 10^{-5}$, respectively.

541.132.3 1423

***p*H values of acid-salt mixtures of some aromatic sulphonic acids at various temperatures and a criterion of completeness of dissociation.** HAMER, W. J., PINCHING, G. D., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 31, *pp.* 291–304, *Dec.*, 1943.—A method is described to differentiate betw. completely and incompletely dissociated acids by measurements of the e.m.f. of galvanic cells without liquid junctions. H and Ag|AgCl electrodes and solutions of the acid, its Na or K salt, and NaCl or KCl, are used. The activity coeff. of HCl in such mixtures are calculated by the equation rel. the e.m.f. to the activity of HCl in known conc. of the acid and salts. If the mean values of the activity coeff. of HCl in the mixtures are $\geq$ those predicted by the limiting law of Debye and Hückel, the acid is considered to be completely dissociated. If lower, the acid is incompletely dissociated. The sulphonic acid group in *p*-phenolsulphonic and 4-chlorophenol-2-sulphonic acids may be regarded as completely dissociated into sulphonate and H ions at 10°, 25°, 40° and 60°C. Solutions containing *p*-phenolsulphonic acid, its Na or K salt, and NaCl or KCl, and solutions containing 4-chlorophenol-2-sulphonic acid, its Na salt and NaCl, are suitable for use as *p*H std. Their *p*H values range from 1·2 to 2·5 and vary only slightly with temperature. The significance of the complete dissociation of the sulphonic acid group in the calculation of the ionization constants and *p*H values of sulphonate buffers and indicators is discussed in terms of the tautomeric relations and the theory of colour changes of indicators.

541.132.3 : 535.243 1424

Basic ionization constant of metacresolsulphonphthalein: *p*H values and salt effects. SAGER, E. E., KEEGAN, H. J., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 31, *pp.* 323–343, *Dec.*, 1943.—Spectral transmittancy values at room temperatures approx. 25°C. were obtained for $1{\cdot}25 \times 10^{-5}\ M$ metacresolsulphonphthalein in water and in 0·001 to 8-*M* HCl. In water the indicator exists in the yellow form (*Y*), and H ions from acids convert it into the red form (*R*). The molar conc. of each form of the indicator in various conc. of HCl were computed from the spectrophotometric data. The dissociation const. (K_b) for the reaction of the indicator with HCl is given by the equation $K_b = M_H f_H M_Y f_Y / M_R f_R$, in which *M* and *f*, with appropriate subscripts, represent the molarities and activity coefficients, respectively. The value of K_b is $1{\cdot}98 \times 10^{-2}$ and that of $-\log K_b$ or pK_2 is $1{\cdot}703 \pm 0{\cdot}005$. The indicator is useful over the *p*H range 0 to 3.

541.132.3 : 537.363 *see Abstr.* 1348

541.132.3 : 541.64 : 541.182.4 *see Abstr.* 1429

541.133 : 532.71 *see Abstr.* 1280

541.135.2 1425

Some compounds of iron deposited on both poles simultaneously. ANTONOFF, G. *J. Phys. Chem.*, 48, *p.* 21–23, *Jan.*, 1944.—A deposit on the Pt anode, and on the cathode surrounded by a porous cup, was obtained when a current was passed through a suspension of finely divided Fe ores, or Fe_2O_3, or certain commercial salt solutions, in acidified water. The nature, properties, and explanation of the deposit, which contained Fe and traces of other substances, are discussed. [See Abstr. 3335 (1937)]. N. M. B.

541.144 1426

Photo-reactions. VII. Reactions in sunlight involving (a) rupture of the ethane linkage, (b) dehydrogenation effected by quinone and benzophenone derivatives, (c) addition reactions between ketones and methanes. SCHÖNBERG, A., AND MUSTAFA, A. *J. Chem. Soc.*, *pp.* 67–71, *Feb.*, 1944.—The photochemical formation of benzpinacols by the action of acetone on benzhydrols is described. Xanthopinacol and fluorenopinacol are photochemically transformed in the presence of acetone into xanthone and fluorenone respectively (rupture of the ethane C–C linkage). Similar rupture occurs when the pinacols are treated with *p*-benzoquinone in sunlight. Quinone in sunlight dehydrogenates diphenylmethane, fluorene, xanthen, anthrone, and dinaphthapyran, derivatives of ethane being formed. The photochemical dehydrogenation of diphenylmethane derivatives by diaryl ketones, with formation of derivatives of ethane, is described. None of the reactions mentioned proceeds in the dark.

541.144.8 1427

Photochemical reactions of leuco dyes in rigid solvents. Quantum efficiency of photo-oxidation. LEWIS, G. N., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 65, *pp.* 2419–2423, *Dec.*, 1943.—When the leuco bases of methylene blue, thionine, and Capri blue are illuminated in a rigid solvent, very complex spectrograms are obtained. By using different solvents and observing the changes on standing, the spectra are analysed and the presence of 5 different substances is shown. Two of these are the semiquinone forms; one is identified with the completely oxidized ion of the dye, and the other two are derived from the dimer of the leuco base, which is shown to be the main substance that is photo-oxidized. In this process, one photon produces double oxidation. Leuco crystal violet, leuco malachite green and Michler's hydride behave similarly. Some data on quantum yield are given. [Abstr. 1537 (1943)]. N. M. B.

541.144.8 1428

Further photo-oxidations in rigid media. LEWIS, G. N., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 65, *pp.* 2424–2426, *Dec.*, 1943.—A further study is made of the odd ions and radicals produced by the illumination of many types of organic substances in a rigid solvent. The spectra of these substances were determined. That these laws are different from those for ordinary molecules is shown by the colour of the odd ion of *m*-phenylenediamine and by the auxochrome effects in substituted benzenes. The rôle of electron ejection in ordinary photo-chemical processes is discussed.

541.18 : 535.515 = 3 *see Abstr.* 1324

541.182.025 : 537.214 *see Abstr.* 1343

541.182.4 : 541.132.3 : 541.64 1429

Emulsion polymerization. FRYLING, C. F., AND HARRINGTON, E. W. *Industr. Engng Chem.*, 36, *pp.* 114–117, *Feb.*, 1944.—The addition of monomers to aq. soap solutions is accompanied by an initial decrease in *p*H attributed to solubilization, with the formation of micelles in the aq. phase, followed by an increase which is the result of solution of fatty acids in the monomer phase. This lends support to the theory that the emulsion polymerization of synthetic rubber is initiated in the aq. phase.

541.183.55 : 66.047.8 1430

Bauxite as a drying adsorbent. LANDE, W. A. LA, JR., MCCARTER, W. S. W., AND SANBORN, J. B. *Industr. Engng Chem.*, 36, *pp.* 99–109, *Feb.*, 1944.—The activation of trihydrate bauxites up to 1 600°F. was studied with ref. to production of an efficient drying adsorbent. Data are presented to show the rel. between activation temperature, residual volatile-matter content, surface area, dry gas capacity and equilibrium capacity. The mechanism of the thermal decomposition of bauxite is discussed with ref. to the results of differential thermal and X-ray diffraction analyses. The max. dry gas capacity is attained by activation at 700°–750°F. This treatment reduces the volatile-matter content from 28–30% to 6–8%. Under optimum activating and operating conditions bauxite will adsorb 11–16% by wt. of water before any moisture is detectable in the effluent. Activated bauxite may be regenerated by heating at 300°–500°F.

541.265 : 547.233 : 532.612.4.08 *see Abstr.* 1278

541.45 1431

The Lewis and the Brönsted–Lowry definitions of acids and bases. KOLTHOFF, I. M. *J. Phys. Chem.*, 44, *pp.* 51–57, *Jan.*, 1944.—The proposal is made that acids in the sense of G. N. Lewis be called proto-acids, while the Brönsted–Lowry definition of acids be left unchanged. The Lewis and Brönsted concepts are not contradictory and both should be adopted.

541.452 : 541.132 1432

A criticism of the Kirkwood–Westheimer theory of acid strength in the light of existing experimental data for the dissociation constants of dibasic acids. WYNNE-JONES, W. F. K., AND RUSHBROOKE, G. S. *Trans. Faraday Soc.*, 40, *pp.* 99–109, *March–April*, 1944.—The paper examines existing experimental data for the influence of solvent or temperature on the dissociation constants of dibasic acids. The Kirkwood–Westheimer theory is in only very qualitative agreement with the experimental data, and several lines of argument lead to the conclusion that this is because the theory takes insufficient account of specific (close-range) interactions between the solvent and solute molecules (or ions).

541.57 : 545.38 1433

Polarographic investigation of hydrogen bonding. II. Some nitrocresols. ASTLE, M. J., AND CROPPER, W. P. **III. Nitrodihydroxybenzenes.** ASTLE, M. J., AND STEPHENSON, S. P. *J. Amer. Chem. Soc.*, 65, *pp.* 2395–2402, *Dec.*, 1943.—Reductions from carefully buffered solutions at the dropping Hg cathode show that when OH is *o*- to an NO_2 group

the reduction of the NO_2 group occurs at more positive potentials than when OH is *p*- or *m*- to NO_2. Compounds of the *o*-class are reduced to the hydroxylamine in acid solutions and completely to the amine in alkaline solutions, while compounds of the *p*-class are reduced completely to the amine at all *p*H values. This indicates stabilization of the hydroxylamine in the *o*-class compounds through intramol. H bonding. Compounds of the *m*-class are reduced in acid solutions, first to the hydroxylamine and then to the amine; in basic solutions to the hydroxylamine stage only. Current/voltage curves obtained for the reduction of 5 nitrodihydroxybenzenes show that the NO_2 groups are more easily reduced when intramol. H bonds are sterically possible. The presence of a second OH group on the C_6H_6 ring weakens the H bond between the NO_2 group and the OH *o*- to it. The ease of reduction of the NO_2 groups in basic solution seems to be a function of the relative arrangement of the two OH groups. [Abstr. 1535 (1943)].

N. M. B.

541.6 : 53 : 547.2 1434

Higher paraffin hydrocarbons. FRANCIS, A. W. *Industr. Engng Chem.*, 36, *pp.* 256–260, *March*, 1944.—The observed densities and refr. indices of paraffin hydrocarbons above C_{11} are correlated. 83 of the hydrocarbons fall into 5 classes according to structure. Their properties are calculated by functions of the form, $A - (B/n)$, where n is the number of C atoms. The same properties of the other 47 observed paraffins are calculated by adding increments dep. upon the mode of building their structures from those of lower known paraffins. The 32 observed normal b.p. of branched-chain paraffins above C_{11} are correlated by similar methods but show poorer agreement.

541.6 : 537.533.73 1435

The investigation by electron diffraction of the structures of some halogen derivatives of tin, arsenic, and nitrogen. SKINNER, H. A., AND SUTTON, L. E. *Trans. Faraday Soc.*, 40, *pp.* 164–184, *May*, 1944.—Electron diffraction by the vapours was used to determine the structures of the methyl-chloro, methyl-bromo, and methyl-iodo Sn compounds, and of cacodyl chloride, bromide, and iodide. In general, when the number of halogen atoms replacing hydrogen or methyl on a central atom is increased, the bonds between them and that atom become progressively shorter. This generalization can be explained on the theory that bond contractions are a function of differences of electro-negativity, but not on the theory that they are due to multiple bonding between the halogen atom and the central atom with no account being taken of the effects of charge redistribution to which the multiple bonding would give rise.

541.6 : 547.962.3 1436

The structure of an egg-albumin–detergent complex. PALMER, K. J. *J. Phys. Chem.*, 48, *pp.* 12–21, *Jan.*, 1944.—A structure is postulated, consisting of a polar protein monolayer with the detergent molecules adsorbed on one side only and with the long axes of the detergent molecules $\perp$ the protein layer. If the layer structure for native egg albumin postulated by Pauling is acceptable, the layers in the native configuration are polar. By use of this model a plausible structure is postulated for the complex which forms between native egg albumin and detergent.

541.62 : 547.214 : 541.128.1 *see Abstr.* 1416

541.62 : 547.665 1437

The tautomerism of indene. KÖELSCH, C. F., AND SCHEIDERBAUER, R. A. *J. Amer. Chem. Soc.*, 65, *pp.* 2311–2314, *Dec.*, 1943.—The synthesis of indenyl-5-oxyacetic acid and of indenyl-6-oxyacetic acid is reported. The existence of these two substances indicates that the non-benzenoid double bond of an indene is in a fixed position, even when the indene has no substituent group in its 5-membered ring.

541.634 : 541.124.7 : 537.226.2 1438

Transformation of diazocyanides. SABOOR, M. A. *Indian J Phys.*, 17, *pp.* 223–228, *Aug.*, 1943.—The rate of spontaneous transformation of *cis-p*-chlorobenzenediazocyanide into the *trans*-isomeride was followed in benzene and CCl_4 solutions by the change in permittivity. The half-life period appears to be independent of the initial conc. and the change is of the first order. From measurement of the velocity constants of the transformation carried out at different temperatures, the activation energy is 23 kg. cals. in either benzene or CCl_4 solution.

541.64 : 541.124 1439

The polymerization of styrene in the presence of nitrothiophene and chloranil. PRICE, C. C. *J. Amer. Chem. Soc.*, 65, *pp.* 2380–2381, *Dec.*, 1943.—Analysis of samples of polystyrene prepared in the presence of α-nitrothiophene and chloranil demonstrated the presence of the elements of these substances in the polymer. Nitrothiophene acts as a retarder; chloranil appears to act merely as a chain-transfer agent.

541.64 : 541.124.7 1440

Chain transfer in the polymerization of styrene: the reaction of solvents with free radicals. MAYO, F. R. *J. Amer. Chem. Soc.*, 65, *pp.* 2324–2329, *Dec.*, 1943.—Certain solvents reduce the mol. wt. of polymerizing styrene because they transfer H or Cl atoms to growing polymer radicals. The activity of the polymer radical is thus transferred to the solvent residue which may start a new chain. In order to compare solvent reactivities in these chain transfer reactions, a simple theoretical development leads to definition of the transfer const. which is characteristic of a solvent. Several transfer constants have been calculated from data in the literature. Activation energies for chain transfer are calculated for some hydrocarbon solvents.

541.64 : 541.128.1 *see Abstr.* 1417

541.64 : 541.132.3 : 541.182.4 *see Abstr.* 1429

541.64 : 547.3 : 537.523.3 *see Abstr.* 1353

541.64 : 621.315.616.9 1441

The polymerization of styrene and some concepts of the electrical properties of plastics. WARNER, A. J. *Elect. Commun.*, 21, 3, *pp.* 180–193, 1943.—[Abstr. 1129 B (1944)].

541.651.22 : 535.343.3 *see Abstr.* 1319

541.66 : 532.14 : 532.133 *see Abstr.* 1274

541.8 : 541.132 *see Abstr.* 1421, 1422

542.44 : 621.365.419 1442

A quenching furnace suitable for small specimens. OWEN, E. A. *J. Sci. Instrum.*, 21, *pp.* 65–66, *April*, 1944.—[Abstr. 1178 B (1944)].

542.48 1443

A still for the continuous production of double distilled water. MICKELSEN, O., BENTON, W. W., AND PHELAN, J. A. *Science*, 99, *pp.* 149–150, *Feb.* 18, 1944.

542.952.6 : 678.7 1444

Emulsion polymerization of synthetic rubber in 10-gramme systems. FRYLING, C. F. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 1–4, *Jan.* 15, 1944.—In developing practical recipes for the manufacture of synthetic rubber, it was desirable to investigate the effects on the polymerization process of a large variety of highly purified substances. The experimental procedure consists of sealing the ingredients of a polymerization recipe into a test tube and rotating the tube at a constant temperature, following the course of the reaction by noting the decrease in volume of the system. The latex is removed for coagulation when the polymerization has proceeded as far as desired, and the yield is determined by weighing the dried stabilized coagulum.

[544.6 + 545.822] : 621.385.1 1445

Spectrographic analysis in the manufacture of radio tubes. PARSONS, S. L. *Proc. Inst. Radio Engrs, N.Y.*, 32, *pp.* 130–135, *May*, 1944.—[Abstr. 1205 B (1944)].

545.37 1446

Neutralization reactions in selenium oxychloride. Potentiometric titration. PETERSON, W. S., HEIMERZHEIM, C. J., AND SMITH, G. B. L. *J. Amer. Chem. Soc.*, 65, *pp.* 2403–2406, *Dec.*, 1943.—The Müller retarded electrode was adapted to potentiometric titration of non-protonic acid-base systems in Se oxychloride. An 0·1 *M* KCl ref. electrode was developed. The rel. strength of non-protonic acids and non-protonic bases in the oxychloride was determined.

545.38 : 541.57 *see Abstr.* 1433

545.82 : 535.33.03 *see Abstr.* 1304

[545.822 + 544.6] : 621.385.1 *see Abstr.* 1445

545.822 : 535.331 : 535.33.03 *see Abstr.* 1302

545.822 : 546.46 : 535.331 *see Abstr.* 1310

545.822 : 669.14 : 535.33.03 *see Abstr.* 1305

545.822 : 669.14 : 621.775.7 1447

The use of briquets formed from metal grindings for the spectrographic analysis of steel. NUSBAUM, R. E., FRY, D. L., AND HACKETT, J. W. *J. Opt. Soc. Amer.*, 34, *pp.* 33–40, *Jan.*, 1944.—An analytical technique is described in which briquets, made from the material to be analysed, are used as electrodes in the arc or spark. The particles used are smaller than 150 mesh and are got by grinding, fragments of the grinding wheel being removed by magnetic or electrostatic separation. $\frac{1}{4}$ in. briquets are made by mixing with carbon and application of pressure. Analysis for Mn, Si, Cr, Mo gives results comparable with those obtained from specimens in the shape of rods. A. H.

545.828 : 621.383 1448

The application of multiplier phototubes to quantitative spectrochemical analysis. BOETTNER, E. A., AND BREWINGTON, G. P. *J. Opt. Soc. Amer.*, 34, *pp.* 6–11, *Jan.*, 1944.—[Abstr. 1202 B (1944)].

545.844 1449

The separation of some methylated sugars by chromatographic adsorption of their azoyl esters. MERTZWEILLER, J. K., CARNEY, D. M., AND FARLEY, F. F. *J. Amer. Chem. Soc.*, 65, *pp.* 2367–2368, *Dec.*, 1943.—The *p*-phenylazobenzoyl esters of several methylated glucoses were prepared according to a modification of the Freudenberg procedure. Separations of mixtures of these compounds were accomplished by the chromatographic adsorption method with nearly quantitative results. Of particular concern was the separation of the ternary mixture of the esters of 2,3-dimethylglucose, 2,3,6-trimethylglucose, and 2,3,4,6-tetramethylglucose.

546.391.2 : 535.338.42 *see Abstr.* 1315

546.411.1 : 535.338.4 *see Abstr.* 1313

546.46 : 545.822: 535.331 *see Abstr.* 1310

546.47-31 : 548.24 *see Abstr.* 1457

546.48 : 535.338.3 *see Abstr.* 1311

546.546.131 : 536.75 : 536.63 *see Abstr.* 1341

546.683 : 535.338.3 *see Abstr.* 1312

546.717 : 538.214 *see Abstr.* 1370

546.725 : 538.214 *see Abstr.* 1371

546.792 : 539.163.2 = 3 *see Abstr.* 1386

546.862.6 : 535.338.4-31 *see Abstr.* 1314

547.2 : 53 : 541.6 *see Abstr.* 1434

547.21 : 532.691 *see Abstr.* 1279

547.213/.214 : 535.338.42 *see Abstr.* 1316

547.214 : 541.62 : 541.128.1 *see Abstr.* 1416

547.233 : 541.265 : 532.612.4.08 *see Abstr.* 1278

547.3 : 541.64 : 537.523.3 *see Abstr.* 1353

547.458 : 535.566.2 *see Abstr.* 1325

547.5 : 535.343-31 *see Abstr.* 1318

547.665 : 541.62 *see Abstr.* 1437

547.962.3 : 541.6 *see Abstr.* 1436

548.0 : 535.54 = 3 1450

On the measurement of atomic radiation fields in crystals. HELLWEGER, K. H. *Z. Phys.*, 119, 5–6, *pp.* 325–333, 1942.—The two conditions dependent on the crystal symmetry which must be fulfilled in order to determine the character as well as the orientation of the sources of radiation, from the polarization of the absorbed or emitted radiation, are discussed. They are not fulfilled simultaneously in crystals of the lowest (triclinic) and highest (cubic) symmetry, only in crystals of the intermediate systems. The results accord with the measurements. Further measurements are necessary, giving exact indications of the intensity distribution, and, above all, for monoclinic crystals. H. G. S.

548.0 : 536.631 : 535.338.42 *see Abstr.* 1317

548.0 : 536.7 : 512.94 1451

Crystal statistics. I. A two-dimensional model with an order-disorder transition. ONSAGER, L. *Phys. Rev.*, 65, *pp.* 117–149, *Feb.* 1 *and* 15, 1944.—The partition function of a 2-dimensional ferromagnetic with scalar spins (Ising model) is computed rigorously for the case of vanishing field. The eigenwert problem involved in the corresp. computation for a long strip crystal of finite width (*n* atoms), joined straight to itself around a cylinder, is solved by direct product

decomposition; for $n = \infty$ an integral replaces a sum. The 2-way infinite crystal has an order-disorder transition at a temperature $T = T_c$ given by the condition $\sinh(2J/kT_c)\sinh(2J'/kT_c) = 1$. The energy is a continuous function of T; but the sp. ht. becomes ∞ as $-\log|T - T_c|$. The free energy of a (0 1) boundary between areas of opposite order is computed; on this basis the mean ordered length of a strip crystal is $[\exp(2J/kT)\tanh(2J'/kT)]^n$.

548.0 : 553.621 1452

Inspection, grading and classification of quartz. SHORE, S. X. *Communications*, 23, *pp.* 28–32 *and* 110–111, *Oct.*, 1943.—Raw quartz may contain many flaws which require analysis. Visual inspection in an oil bath using both polarized light and a bright light source reveals optical twinning, cracks, inclusions, bubbles, chuva and ghosts. Electrical twinning must be revealed by other tests. The commonest is sand blasting and etching in ammonium bifluoride which attacks especially twinned areas. Raw quartz is graded as faced or unfaced and by weight and percent usability into 14 groups. C. F. B.

548.0 : 553.621 1453

The use of quartz orientation devices and sawing equipment. SHORE, S. X. *Communications*, 23, *pp.* 24–28, 30–31 *and* 91, *Dec.*, 1943.—Describes the apparatus and procedure used for "wafering" the raw quartz in the manufacture of BT-cut crystals. C. F. B.

548.0 : 553.621 1454

Quartz-lapping and finishing. SHORE, S. X. *Communications*, 24, *pp.* 46, 47, 50, 52, 79–81, 91, 94, *Jan.*, 1944.—Describes methods used in finishing BT-cut crystals from wafers sawn from the mother quartz. Etching reveals optical and electrical twinning, and electrical twinning is revealed by the measurement of resonant frequency. The crystals are lapped and hand-finished and checked electrically by comparison with a standard crystal, and mechanically by observing the Newton's rings produced when in contact with an optical flat. C. F. B.

548.0 : 553.621 1455

Quartz-testing. SHORE, S. X. *Communications*, 24, *pp.* 58, 60, 62, 65–66 *and* 96–98, *Feb.*, 1944.—Describes the final steps in quartz crystal production including ageing and testing for frequency, activity and temp. coeff. The grid current of an oscillating valve using the crystal gives an indication of the activity. The tests are made and recorded by automatic equipment over a range of temperatures. The commonest faults and "salvage" methods are discussed. C. F. B.

548.0 : 621.3.015.5 = 3 1456

Electrical disruption of insulating crystals. WOROBJEW, A. A. *J. Phys., USSR*, 3, 2, *p.* 73, 1940.—[Abstr. 1112 B (1944)].

548.24 : 546.47-31 1457

Twinning in zinc oxide. FULLER, M. L. *J. Appl. Phys.*, 15, *pp.* 164–170, *Feb.*, 1944.—A crystallographic analysis of a characteristic shape of particle found in ZnO produced by burning Zn vapour was made with the electron microscope. This particle consists of 4 needle-shaped crystals united at a common juncture. The spatial angles among the 4 crystals were determined from stereoscopic micrographs with the use of the stereographic projection. The crystals were united by twinning on planes of the form (112).

548.73 : 536.7 : 669.25 1458

Correspondence on paper by O. S. Edwards and H. Lipson: "An X-ray study of the transformation of cobalt." *J. Inst. Met.*, 70, *pp.* 125–126, *March*, 1944.—[See Abstr. 2009 (1943)].

548.73 : 539.4.016 1459

The diffraction of X-rays by distorted-crystal aggregates. I. STOKES, A. R., AND WILSON, A. J. C. *Proc. Phys. Soc., Lond.*, 56, *pp.* 174–181, *May*, 1944.—Broadening of the Debye–Scherrer lines in X-ray photographs of cold-worked metals has been attributed (i) to breaking up of the crystals into crystallites whose linear dimensions are $\lesssim 10^{-5}$ cm., (ii) to the presence of crystal grains of different lattice parameters, and (iii) to distortion of comparatively large crystal grains. The broadening to be expected on the last hypothesis is worked out approximately. The "apparent strain" is given by $\eta \equiv \beta\cot\theta = 2/\phi_{hkl}(0)$, where β is the (corrected) integral breadth of the *hkl* reflection, θ is the Bragg angle, and $\phi_{hkl}(e)de$ is the fraction of the crystal for which the tensile strain in the *hkl* direction is between e and $e + de$. In cubic crystals, plausible assumptions lead to $\eta^2 = A + BH$, where A and B are constants involving the elastic moduli and the m.s. values of the direct and shear stresses, and $H \equiv (k^2l^2 + l^2h^2 + h^2k^2)/(h^2 + k^2 + l^2)^2$.

548.73 : 549.211 1460

Lattice constant of diamond and the C–C single bond. RILEY, D. *Nature, Lond.*, 153, *pp.* 587–588, *May* 13, 1944.—[See Abstr. 723 (1944)].

548.73 : 621.794 1461

The apparent microstructure produced by hydrofluoric acid etching reagents on pure iron and iron-silicon alloys. WRAŻEJ, W. J. *J. Iron Steel Inst.*, [10 *pp.*], *April*, 1944. *Advance copy.*—It is shown that, when Fe-Si alloys, pure Fe, carbon steel or cast Fe are etched with HF, or with mixtures of HF and HNO_3, scars ("barley-shell" markings) are produced when the FeF_2 formed has an opportunity of crystallizing. These scars, which have been thought to reveal a microstructure, are brought to light when the FeF_2 is removed. They are the places where the crystals have been embedded and have therefore nothing to do with the structure of the alloy or with its composition or condition. The structure of the crystals produced by HF is different from that of those produced by HF and HNO_3. From X-ray analysis it is considered that the former structure is hexagonal with $c = a = 9{\cdot}645$ Å. J. T.

549.211 : 548.73 *see Abstr.* 1460

550.34 1462

Bibliography of seismology, Jan.–June, 1943. HODGSON, E. A. *Publ. Dom. Obs. Ottawa*, 13, *pp.* 215–231, 1943.—[See Abstr. 1256 (1943)].

550.381 : 523.74 1463

The earth's and the sun's permanent magnetic fields in the unitary field theory. SCHRÖDINGER, E. *Proc. Roy. Irish Acad.*, 49*A*, *pp.* 135–148, *Nov.*, 1943.—The author's theory [Abstr. 2514 (1943)] is shown to predict a modification of a Gaussian dipole field which is identical with the "external" field found by geo-

magnetic surveys, if the characteristic length μ^{-1} in the field equations is of the order of 30 000 km. It also predicts, as a consequence of the non-axiality of the main dipole field, a distribution of vertical currents in the atmosphere which may be connected with the 'non-potential" geomagnetic field. The assumption of a value for μ^{-1} not cosmically large also throws light on some peculiar features of the Sun's magnetic field. A. HU.

551.3.051 1464

The sediments of four woodland lakes, Vilas County, Wisconsin. I–II. TWENHOFEL, W. H., MCKELVEY, V. E., CARTER, S. A., AND NELSON, H. *Amer. J. Sci.*, 242, *pp.* 19–44, *Jan., and pp.* 85–104, *Feb.*, 1944.—The lakes are surrounded by forest and no parts of the surrounding lands have been cultivated. The lake basins are pits in outwash and the shores are largely composed of sands. Shores are generally low, wave attack upon them is weak, and contribution of sediments from the shores is small. Sampling was done of the sediments on the present bottom and, by means of core samplers, of the sediments which have accumulated since the origin of the lakes. The sampling shows the slow rate of accumulation of the sediments.

551.311.12 : 551.521.1 *see Abstr.* 1471

551.311.13 : 551.79 1465

Dating of the real Quaternary ice age contra local mountain glaciations. GEER, G. DE. *Ark. Mat. Astr. Fys.*, 28*B*, 2, *No.* 9, [5 *pp.*], 1942.—Measurements of glacial melt varves at 20 different localities in the Alps correspond exactly with similar measurements in Sweden. It is deduced that all known Quaternary varves belong to a single world-wide ice age, though local glaciations have since been caused by topographic elevations above the snow-line. The occurrence of earlier widespread glaciations which have left pre-Quaternary varves suggests that alterations in solar radiation have recurred in past ages. A. HU.

551.501.42 : 518.3 : 551.547 *see Abstr.* 1475

551.501.6 = 60 1466

A cartographic scheme for climatology. KNOCHE, W. *Bull. Amer. Met. Soc.*, 24, *pp.* 379–383, *Dec.*, 1943.—Any iso-line can also represent the geographical variation of 2 other factors along itself if it is made to consist of numbers in variable colour or typography. An example is given of July isohyets in Argentina, where the lines are composed of numbers representing temperature on a decimal scheme on a typographical scale which represents the aridity coefficient. A. HU.

551.501.7 1467

Non-instrumental determination on the ground of ceiling, icing layers, turbulence, and winds aloft. BROOKS, C. F. *Bull. Amer. Met. Soc.*, 24, [2 *pp.*], *Jan.*, 1943.

551.508.5 : 551.551 1468

Gustiness under various weather conditions. FERGUSSON, S. P. *Bull. Amer. Met. Soc.*, 24, [7 *pp.*], *Jan.*, 1943.—A sensitive rotation anemometer is described which records wind gusts on paper moving at 60 mm./min. The 3-bladed balsawood element rotates once per 0·5 m. of air movement, and can measure 5 changes of velocity per sec. Its time scale can be expanded to 40 mm./sec. for studying detailed wind structure. The frequency and amplitude of velocity of gusts are found to be higher on days of strong convection than when vertical velocities are small. The importance of the study of gustiness in aeronautics and structural engineering is indicated. A. HU.

551.510.535 : 525.75 *see Abstr.* 1266

551.513.1 1469

Simplification of the acceleration potential in an isentropic surface. BROOKS, E. M. *Bull. Amer. Met. Soc.*, 23, [8 *pp.*], *May*, 1942.—The procedure for finding the wind flow in an isentropic surface is simplified by utilizing the fact that at a given level the acceleration potential is uniquely determined by the pressure. New tables, which are given for every 5 000 ft. up to 20 000 ft., eliminate drawing adiabatic charts and reduce to less than half the time necessary to deduce the flow patterns in isentropic surfaces. An example is given of the new procedure. A. HU.

551.515.8 1470

The air masses of West Africa. HUBERT, H. *Bull. Amer. Met. Soc.*, 24, *pp.* 351–354, *Nov.*, 1943.—Upper-air observations are used to give seasonal mean distributions of air masses and fronts over the W. part of tropical Africa. Identification of the air masses is by wind direction and humidity, not by temperature, which changes only gradually with the passage of a front. Perspective block diagrams show the wind direction and the depth and superposition of the air masses for Feb. and for Aug. at 20 stations. A. HU.

551.521.1 : 551.311.12 1471

Some effects of vertical insolation upon the Kilimanjaro glaciers. SPINK, P. C. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 261–264, *Oct.*, 1943.—The effect of equatorial sunshine on ice formations in the cauldron of Mt. Kibo (19 000 ft.) is described and illustrated. The glaciers are "dead" and are slowly retreating, because little new ice is being formed, and melt water is quickly absorbed into the underlying lava and cannot re-freeze. The ice formations are quite unlike any in non-tropical latitudes. Monthly readings of 4 rain-gauges on the mountain are projected. A. HU.

551.521.3 : 525.733 : 523.72 *see Abstr.* 1242

551.521.63 : 551.590.21 1472

Ultra-violet and daylight rays in relation to the seasons and the solar cycle. ASHWORTH, J. R. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 275–281, *Oct.*, 1943.—A photometer is described in which diffuse light from the zenith sky, after passing through a step-wedge filter, falls on a drum of sensitized paper. Two such instruments are mounted together, one with a window transmitting only ultra-violet light (UV), the other transmitting integrated sky-light (D). Intensity spots are recorded for one hour at intervals of 3 hr. throughout the day, the number visible giving a logarithmic measure of intensity in the 2 wavelength regions. Eleven years' observations show that the annual mean of UV/D varies closely with sunspot number, and that the seasonal and diurnal variations of UV/D follow the curve of ionization in the upper atmosphere. A. HU.

551.524 : 551.526.6 *see Abstr.* 1474

551.524.35 1473

The interdiurnal variability of temperature on Mt. Washington. CONRAD, V. *Trans. Amer. Geophys. Un., pp.* 279–283, 1942.—The 3-year temperature tables of the Mt. Washington Observatory (alt. 6 270 ft.) are used to study the day-to-day variations of atmospheric temperature. The parameter chosen is the difference betw. the temperatures at 5 a.m. and at 2 p.m. on consecutive days; the connection betw. this and the usual daily-mean difference is close. The seasonal distribution of warmings and coolings $\geqslant 20°F.$ is shown in tabular form. The mean interdiurnal variability is 7°F. for warming and 8°F. for cooling, max. values of 5 times these occurring in winter. The temperature-balance curve suggests a quantum-like process of atmospheric cooling in autumn. Tables of "temperature surges," periods in which successive days show increasing or decreasing temperature, are given and their use in long-range forecasting is indicated. A. HU.

551.526.6 : 551.524 1474

On the relation of the surface temperature of the sea to the air temperature. SANDSTRÖM, J. W. *Ark. Mat. Astr. Fys.*, 28*A*, 3, *No.* 13, [24 *pp.*], 1942.—A statistical analysis is made of observations of sea surface temperatures in the N.E. Atlantic during the period 1900–1937. January isotherms are plotted for the whole period and for the 4 decades. Comparison with the air temperature isanomals suggests that an exceptionally warm Gulf Stream produces increased cyclonic activity over the N. Atlantic, resulting in strong S. winds (high air temperatures) over Scandinavia and in strong N. winds (low air temperature) over W. Greenland. The mechanism of the atmospheric circulation produced is described in some detail. A. HU.

551.547 : 551.501.42 : 518.3 1475

Description of a nomogram for the rapid mental computation of 10 000 ft. ocean extrapolations. MAZLEN, H. G. *Bull. Amer. Met. Soc.*, 24, *pp.* 349–351, *Nov.*, 1943.—A nomogram is described, and rules for and exceptions to its use are given, for mentally checking the values of pressures at 10 000 ft. over ocean areas, extrapolated from sea-level observations. A. HU.

551.55 : 614.72 *see Abstr.* 1491

551.551 : 551.508.5 *see Abstr.* 1468

551.552 1476

Variations in wind velocity near the ground. CARRUTHERS, N. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 289–301, *Oct.*, 1943.—The relation betw. mean wind velocity and height (up to 500 m.) is examined with a view to facilitating the estimation of velocity from records taken at heights and exposures differing from the standard values. The effects on gustiness of height, of change of mean velocity and direction, and of seasonal and diurnal conditions, are considered. A general approx. law connecting mean velocity with height is suggested, and extrapolation tables are given. A. HU.

551.555.8 1477

On haboobs in the Egyptian Sudan. SCHEMPF, W. H. *Bull. Amer. Met. Soc.*, 24, *pp.* 371–377, *Dec.*, 1943.—The annual variation in pressure distribution over Egypt is attributed to the yearly progression of the depression associated with the thermal equator across the Sudan to Arabia and back. In the transition months, Oct. and May, Khartoum experiences thunderstorms and haboobs. The typical haboob is described, and pseudo-adiabatic charts and upper-wind hodographs are given from aircraft soundings for the haboob of Apr. 20–21, 1936. The phenomenon is attributed to a frontal zone acting as a trigger which releases the latent instability in the air mass already present over the haboob locality. A. HU.

551.557 1478

Upper winds at Fort-Lamy (Chad). GOUAULT, J. *Bull. Amer. Met. Soc.*, 24, *pp.* 340–348, *Nov.*, 1943.—Data on wind velocity in the upper atmosphere at Fort-Lamy are given from balloon observations made betw. 1932 and 1937. The meteorological characteristics associated with the S.W. monsoon, which blows from Apr. to Oct., and with the N.E. harmattan (Nov.–March), are described. Graphs show seasonal variations in the height/speed relation for winds aloft, and a marked diurnal variation of wind speed at 500 m. is found during the harmattan. The bearing of the results on forecasting for aviation is indicated. A. HU.

551.57 : 536.42 : 536.24 = 3 *see Abstr.* 1334

551.574.42 1479

The microscopic structure of rime. ARENBERG, D. L., AND ELSNER, R. W. *Bull. Amer. Met. Soc.*, 23, *pp.* 276–280, *June*, 1942.—Photomicrographs are reproduced of rime deposited on various surfaces at various temperatures and under different wind conditions. The photographs suggest that the deposit is initially of supercooled droplets about 0·02 mm. in diam. which coalesce before freezing. A. HU.

551.576.1 1480

Clouds in aerology and forecasting. BROOKS, C. F. *Bull. Amer. Met. Soc.*, 22, *pp.* 335–345, *Nov.*, 1941.—Deviations from 100% humidity in various types of cloud are explained, and the effect of lapse rate on the thickness, form and rate of growth of clouds, is discussed. The use of cloud motion in interpreting wind, shear and turbulence in the free air, is indicated, and examples are given of how the texture, forms and motions of clouds can guide the forecaster. A. HU.

551.577.2(7) 1481

United States daily and 14-day precipitation normals. VISHER, S. S. *Bull. Amer. Met. Soc.*, 24, *pp.* 359–370, *Dec.*, 1943.—Daily precipitation normals, and 14-day sums of these normals, at each of about 200 U.S. Weather Bureau stations, based on observations during the period 1878–1927, are used to draw maps showing regional contrasts in precipitation distribution. The bearing of the data on weather forecasting and on the study of soil fertility and erosion is indicated. A. HU.

551.577.2(73) 1482

Precipitation regions in the United States. VISHER, S. S. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 265–273, *Oct.*, 1943.—Regional maps of the U.S. are drawn on the following bases: average precipitation (annual and seasonal); percentage of precipitation falling at night; reliability of precipitation; and intensity of rainfall. The climatic causes of the major regions are discussed,

and special attention is given to the frequency of torrential rains. A. HU.

551.582 : 355.4 1483

World climate and world war. CONRAD, V. *Bull. Amer. Met. Soc.*, 23, *pp.* 264–273, *June*, 1942.—Ice, fog and wind conditions in the extreme N. Atlantic are described, with special reference to the surface supply route betw. U.S.A. and U.S.S.R. and to the air route which rounds Iceland. The latter is advantageous in spring owing to the E. winds in the low atmospheric layers and the W. winds aloft. The climatic features of Iceland are described, and an appendix gives numerical climatic tables for 4 places on the N., E., S. and W. coasts. A. HU.

551.582 : 551.588.2(42) 1484

Further climatological averages for the northern Pennines, with a note on topographical effects. MANLEY, G. *Quart. J. Roy. Met. Soc.*, 69, *pp.* 251–261, *Oct.*, 1943.—Ten years' meteorological records made at a station in upper Teesdale (1 840 ft.) and 3 years' observations on a nearby summit (2 735 ft.) are reduced and compared. They include a continuous record of temperature, weekly rainfall records over 6 years, and some collected data on snowfall and snow cover. The production of night temperature minima is discussed in relation to the stagnation of cold air in the upper Tees basin following katabatic flow from the uplands. A. HU.

551.586 1485

On the practical evaluation and interpretation of the cooling power in bioclimatology. STONE, R. G. *Bull. Amer. Met. Soc.*, 24, *pp.* 295–305, *Oct.*, and *pp.* 327–339, *Nov.*, 1943.—The use of the katathermometer and its modifications in measuring the cooling power of the human climatic environment is described, and the relation betw. the physical and physiological cooling powers examined. The various heat-balance equations proposed for the instruments are compared, and diagrams are drawn relating the cooling power to the air temperature and wind speed. The effects of air density, of solar radiation, of clothing and of wetting, on the measured cooling power are reviewed, and the desirability is emphasized of expressing the observational results in terms of a sensation scale on a physiological basis of comfort and health. A. HU.

551.588.2 : 551.582(42) *see Abstr.* 1484

551.590.21 : 551.521.63 *see Abstr.* 1472

551.593.6 1486

A spot caused by snowflakes in the beam of a ceiling projector. GRAHAM, R. C. *Bull. Amer. Met. Soc.*, 24, *pp.* 378–379, *Dec.*, 1943.—A bright disc appearing in the beam of a searchlight inclined at $\tan^{-1} 3$ to the horizontal, and estimated, from alidade observations 800 ft. away, to be at an altitude of 1 200 ft., is attributed to reflection from horizontal snowflakes. The spot can be distinguished from a thin cloud ceiling if observations give it the same altitude at all positions on the base-line, or if it disappears when viewed from points away from the base-line. A. HU.

551.594.221 = 82 1487

Results by magnetic recording of lightning currents by the power combines of the USSR during the period of 1937–1940. STEKOL'NIKOV, I. S., AND LAMDON, A. A. *J. Techn. Phys., USSR*, 12, 4–5, *pp.* 204–210, 1942. *English Abstr. in Wireless Engr*, 21, *p.* 184, *April*, 1944.—Over 1 000 measurements of the amplitudes of lightning currents were made by ferromagnetic recorders. The results are analysed and it is shown that only in 1% of cases does the current amplitude exceed 140–150 kA, and that it greatly depends on the conductivity of the soil and the protecting circuits. E. R. A.

551.594.221 : 621.3.014.33 : 621.317.2 = 3 1488

The lightning station on Mt. San Salvatore. BERGER, K. *Bull. Ass. Suisse Élect.*, 34, *pp.* 803–805, *Dec.* 29, 1943.—[Abstr. 1141 B (1944)].

551.594.6 : 621.396.821 1489

A further study of atmospherics during the monsoon period. SUBBA RAO, N. S. *Proc. Indian Acad. Sci. A*, 18, *pp.* 127–139, *Sept.*, 1943.—[Abstr. 1261 B (1943)].

551.79 : 551.311.13 *see Abstr.* 1465

553.621 : 548.0 *see Abstr.* 1452, 1453, 1454, 1455

612.11 1490

Standard state of desiccation of dried blood plasma and the advantages of desiccation in the region of molecular flow. MUKHERJEE, J. N., AND MAJUMDAR, B. R. *Proc. Indian Ass. Cult. Sci.*, 26, *pp.* 1–2, *Aug.*, 1943.

612.17 : 537.36 *see Abstr.* 1347

612.79 : 614.825 : 537.311.3 *see Abstr.* 1346

612.8 : 534.838 *see Abstr.* 1297

612.85 : 534.75 = 3 *see Abstr.* 1294

612.85 : 621.317.39 : 534.771 *see Abstr.* 1295

614.72 : 551.55 1491

Atmospheric pollution by heavy industry. HEWSON, E. W. *Industr. Engng Chem.*, 36, *pp.* 195–201, *March*, 1944.—A method of reducing atmospheric pollution by varying the emission of the offending gas with meteorological conditions is described. The application by the Trail smelter (B.C.) for preventing damage by SO_2 to vegetation in the state of Washington is outlined. Investigation of the distribution of winds and SO_2 in the Columbia River Valley near Trail shows that, during the growing season, the majority of fumigations are brought about by the differential heating of the valley sides by the sun. Measured values of atmospheric turbulence and of wind direction and speed are fundamental in the control régime.

614.825 : 612.79 : 537.311.3 *see Abstr.* 1346

621.794 : 548.73 *see Abstr.* 1461

629.1.035 1492

The history of jet propulsion. I–III. *Engineer, Lond.*, 177, *pp.* 44–46, *Jan.* 21; 64–66, *Jan.* 28, *and pp.* 84–86, *Feb.* 4, 1944.—The theoretical considerations of jet propulsion as applied to marine craft are discussed in detail, and the aeronautical aspect is dealt with. The gas turbine is mentioned as the most likely prime mover. Comparative performances of jet- and screw-propelled aircraft are summarized. Typical systems that have been developed, from the Melot's Intensifier to the present-day Caproni–Campini and Whittle systems, are discussed. M.-V.

629.12.037 1493

Marine-propeller blade deflection. CONN, J. F. C. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 157–171,

1943.—The loads acting upon screw propeller blades are investigated and formulae are derived for the more important bending and twisting moments. Approx. methods are presented for calculating the deflections. Numerical results are given fof a heavily loaded destroyer propeller having unraked blades. The most important deflection is a twist of 1° at the blade tips, in the sense of increased pitch.

629.12.037 : 533.662 1494

Calculation of marine-propeller performance characteristics. BURRILL, L. G. *Trans. N.E. Cst Instn Engrs Shipb., pp.* 227–250, 1944. *Advance copy.*—The paper is concerned mainly with the development of a complete strip-theory method of calculation for marine propellers which includes the corrections necessary to take account of the differences between wide-bladed marine propellers and normal air-screw types, in such a way that satisfactory agreement is obtained between theory and practice. The usual momentum and thrust equations are modified to take account of slip-stream contraction consistent with the inflow velocities. A series of std. curves are given which enable the lift and drag characteristics to be calculated for aerofoil and sound back sections. The effect of blade interference is presented in a manner convenient for calculation purposes.

629.123 1495

The coefficient of propulsive efficiency. BARNABY, K. C. *Trans. Instn Nav. Archit., Lond.*, 85, *pp.* 118–141, 1943. *Abstract in Engineering*, 156, *pp.* 368–380, *Nov.* 5, *and pp.* 399–400, *Nov.* 12, 1943.—(P.C.) is the ratio of the naked-hull e.h.p. to the actual trial i.h.p. or s.h.p. unless otherwise stated. Over 1 000 trial results have been analysed, mainly on the basis of Taylor's curves for residuary resistance. These are arranged into type groups. Where the displacement ratio is fairly const. the P.C. values plot satisfactorily on a basis of $v/\sqrt{l}$. Where the displacement ratio varies considerably, this becomes impossible and the valves plot reasonably well on a basis of the ratio residuary h.p./e.h.p. The range of the P.C. values is > accounted for by variation of its constituent parts, such as propeller efficiency. The deduction is drawn that tank experiments have the effect of under-estimating the frictional resistance, and over-estimating the residuary. This is primarily due to neglect of form effect in calculating friction.

66.046 : 535.23-1 *see Abstr.* 1298

66.047.8 : 541.183.55 *see Abstr.* 1430

666 : 679.5 *see Abstr.* 1498

666.24 = 397 1496

Coloured glass. LINDROTH, S. *Tekn. Tidskr.*, 50, (*Kemi*), *pp.* 99–103, *Dec.* 11, 1943.—Colouring ingredients of indirect (Au, Ag, Cu, sulphides and selenides) and direct action (S, Se, oxides and sulphides of Fe, Mn, Cr, Va, Co, Ce) are indicated and their effects discussed. The action of some rare metals (Ti, Ne, Pr, In) is briefly stated.

666.97 : 536.413.3 *see Abstr.* 1336

666.97 : 539.434 *see Abstr.* 1403

669.1 : 535.33.072 *see Abstr.* 1309

669.14 : 539.4.016 *see Abstr.* 1396

669.14 : 545.822 : 535.33.03 *see Abstr.* 1305

669.14 : 620.172.251.2 : 539.434 *see Abstr.* 1402

669.14 : 621.775.7 : 545.822 *see Abstr.* 1447

669.245 : 620.178.3 : 539.431 *see Abstr.* 1397

669.25 : 536.7 : 548.73 *see Abstr.* 1458

669.35 : 620.178.3 : 539.431 *see Abstr.* 1398

669.715 : 532.13 *see Abstr.* 1273

678 : 539.132 *see Abstr.* 1378

678 : 539.389.3 *see Abstr.* 1394

678 : 539.431 *see Abstr.* 1399

678.7 1497

A brief survey of synthetic alternatives to natural rubber. GLOVER, D. W. *P.O. Elect. Engrs' J.*, 37, *pp.* 11–16, *April*, 1944.—The author outlines the methods by which the primary components (or monomers) of the principal synthetic alternatives to natural rubber are produced and the results of polymerizing these. The physical properties of the resulting products after compounding with S, carbon black, etc., are discussed.

678.7 : 542.952.6 *see Abstr.* 1444

679.5 : 532.133 : 532.712 *see Abstr.* 1281

679.5 : 539.264 *see Abstr.* 1389

679.5 : 539.501 *see Abstr.* 1404

679.5 : 666 1498

Fiberglas reinforced plastics: physical properties. ROGERS, T. S. *Mod. Plast.*, 21, 1, *pp.* 88, 140 *and* 142, 1943. *Abstr. in J. Text. Inst.*, 34, *p. A*708, *Dec.* 1943.—The tensile stren[illegible] moisture absorption, co[illegible] resistance and durability, [illegible] in rel. to their use for reinf[illegible] are given showing the physic[illegible] based laminates.

679.52

The future possibilities of [illegible] E. E. *Plastics*, 8, *pp.* 57–64, [illegible] teristics of the material are g[illegible] made with those of cellulose a[illegible] claimed to have advantages. [illegible]s sh[illegible] the effect of exposure to dry heat, water immersion and cyclic heat and humidity. The chemical composition is given, and a table of properties. E. R. A.

691.16 : 539.501 = 3 *see Abstr.* 1405

697.94 : 537.523.3 *see Abstr.* 1354

77 : 159.93 *see Abstr.* 1212

771.534.5 : 621.316.75 : 535.241.33 [illegible]*bstr.* 1300

772 : 541.127 *see Abstr.* 1414

778.3 : 541.126

Study of high explosives by high-s[illegible] CAIRNS, R. W. *Industr. Engng Che[illegible]* 85, *Jan.*, 1944.—A precision rotating-d[illegible] capable of producing a film speed of 180 m/sec. [illegible] built. Its resolving time is 10^{-6} sec. A camera was made with a speed about 10 × as great, through application of a mirror mounted on an air-driven rotor of the Beams type. Details of the apparatus, housing and explosion chamber, are given, the procedure is described and some results are [illegible]wn.

796 : 53.08 *see Abstr.* 1267